TIME DOMAIN ELECTROMAGNETIC SURVEYS FOR ASSISTING IN DETERMINING THE GROUND WATER RESOURCES PHASE II STUDY ISLAND OF LANAI, HAWAII

Prepared For:

Lanai Water Company, Inc.
1223 Fraser Avenue, P.O. Box L
Lanai City, Hawaii 96763

9081-000

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Executive Summary

Time domain electromagnetic (TDEM) surveys were performed by Coleman Energy & Environmental Systems - Blackhawk Geosciences Division (CEES-BGD) under contracts with the Lanai Water Company, to assist in determining the ground water resources of the Island of Lanai, Hawaii. This type of geophysical survey has proven to be a cost effective means to aid in providing an understanding of potential ground water resources on Lanai and other Hawaiian Islands. By comparing TDEM data with known well information and with other surveys in Hawaii, the geophysical data is used to provide knowledge on the geologic/hydrologic regime on the island. A number of wells on Lanai were available for comparison, and they were used to compare interpretations of the ground water resources. Previous TDEM surveys on Lanai and other Hawaiian Islands have reliably mapped the boundary between fresh water in the basal mode and high-level occurrences. Previous surveys were confined to small segments of islands. This is the first investigation covering an entire island, and therefore, provides an opportunity to address the potential water resources of an entire island.

A total of 99 TDEM soundings were collected during three separate periods, February 1993, August 1994, and October-November 1994, and information from twelve wells are available. This report incorporates the findings of all three surveys, and from the twelve wells.

TDEM soundings were collected at locations accessible by vehicle, and on the rugged windward side of the island soundings were acquired using helicopter support. The objective in station location selection was to provide adequate data density around the island for delineating areas of basal ground water from areas where ground water damming structures exist, and where high-level water can occur. Additional soundings were placed in areas not previously surveyed so that a map of the entire island in terms of the geologic/hydrologic regime could be constructed.

The results of the comprehensive evaluation and interpretation of the TDEM geophysical data indicate that:

- Basal ground water is present around the perimeter of the island, but the fresh/brackish water lens is limited. Thicknesses of fresh/brackish water above sea level have been calculated to be a minimal resource.
- A geologic/hydrologic discontinuity interpreted as a ground water damming structure is present around the entire island.
- The potential for high-level ground water is present throughout the central portion of the entire island. Well data was available for comparison to substantiate these findings in twelve areas near Lanai City and in the Palawai Basin area.

1.0 Introduction

This report contains the results of time domain electromagnetic (TDEM) surveys to assist in determining the ground water resources on Lanai Company property on the Island of Lanai, Hawaii. The surveys were performed by Blackhawk Geosciences Division of Coleman Energy & Environmental Systems (CEES-BGD) for Lanai Water Company, Inc. (LWCI), an affiliate of Dole Food Company, Inc. The scope of work (during Phase II of the TDEM survey) included fill-in soundings in all areas accessible by vehicle travel, and some helicopter access in remote areas. Phase II data were acquired from October 25 through November 15, 1994. TDEM survey data taken during August 1994 and February 1993 have been incorporated into this report. The locations of all the TDEM soundings on the island are shown on Figure 1-1.

Ground water resources occur on the Hawaiian Islands basically in two modes:

- in a basal mode where a lens of fresh water floats on saline water, and
- in a high-level mode where the ground water occurrence is controlled by damming structures.

These two modes of ground water occurrences are illustrated in Figure 1-2. Ground water may also occur in areas between these two modes, but production is expected to be highly variable. TDEM surveys previously run on Lanai and other Hawaiian Islands have reliably mapped the boundary between fresh water in the basal mode and high-level occurrences. Normally, this main ground water boundary parallels the coastline in a volcanic setting. Water well production data from the Palawai Basin on Lanai has shown that other secondary damming structures exist above the main damming structure. Figure 1-3 shows a schematic geologic model that can help explain these two types of damming structures. Outlined in the figure is a major ring fracture developed from a caldera which is shown to occur inland and near parallel to the shoreline. Also shown are radial fractures which are thought to form near perpendicular to the major caldera ring fracture. Not shown are subsequent minor ring fractures which are postulated to occur within the major ring fracture. It is also postulated that the fracture areas are zones of weakness where intrusive dikes may preferentially form and these dikes can be impermeable. The radial fractures could be numerous and they could divide the high-level water into different compartments behind the major ring fractures. The resultant water production from a single compartment will be determined by several important factors which include permeability, porosity, size of and recharge to the compartment.

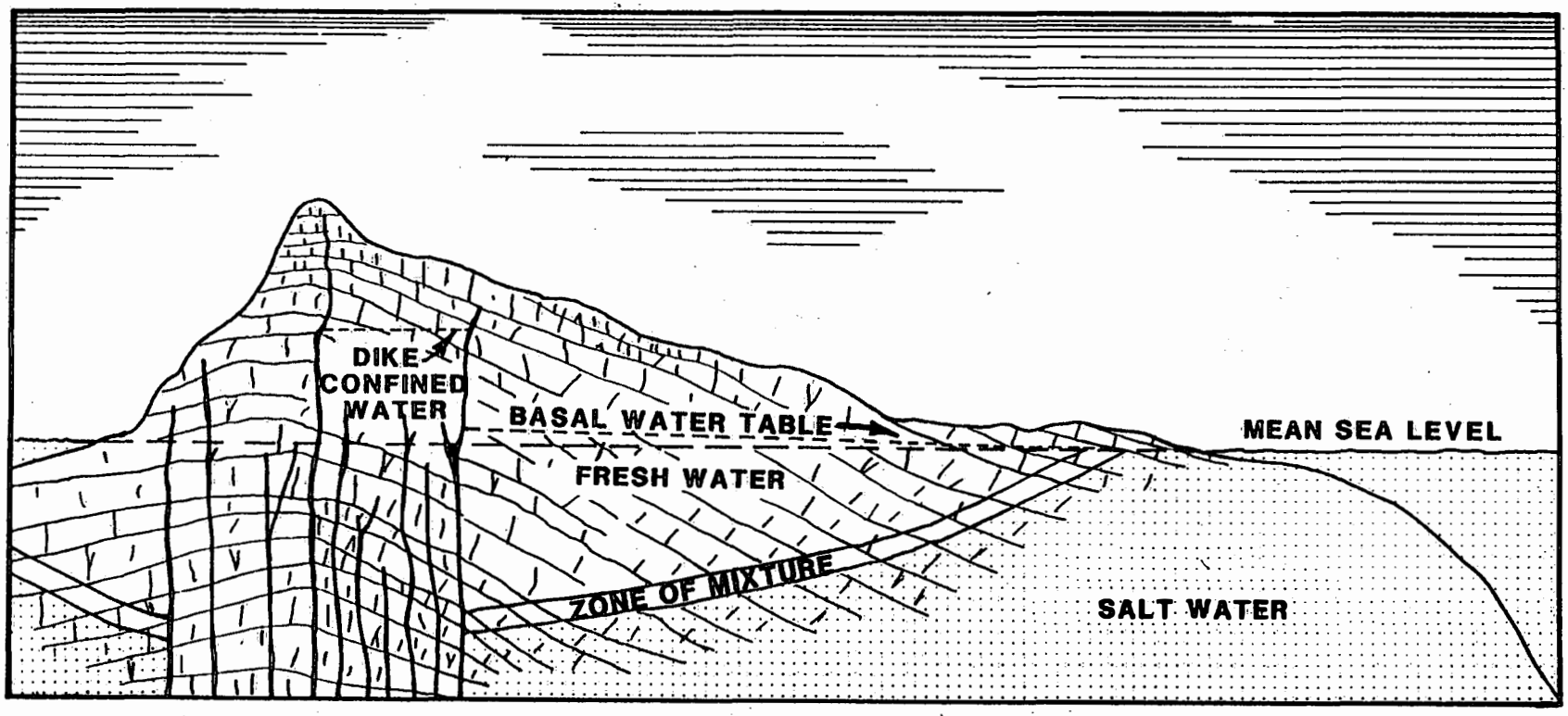
Based on the hydrologic information described above, the objective for the Phase II TDEM survey was to determine the approximate position (both seaward and inland) of the basal to high-level ground water boundary throughout the remaining unsurveyed areas on the island. These areas included the Northwest Rift Zone, Windward Coast and Leeward Coast.

A ground water damming structure has been previously mapped by TDEM surveys above the Manele Bay Hotel and Golf Course. Drill hole results indicate that basal mode water occurs at the approximate 200 ft (61 m) elevation level near the Manele Bay Hotel and that high-level water occurs near the approximate 1,150 ft (350 m) elevation level above the hotel. Furthermore, water well results within the Palawai Basin, and above Lanai City, indicate that secondary damming structures exist within the island above the main caldera ring damming structure.

Map

Goes

Here



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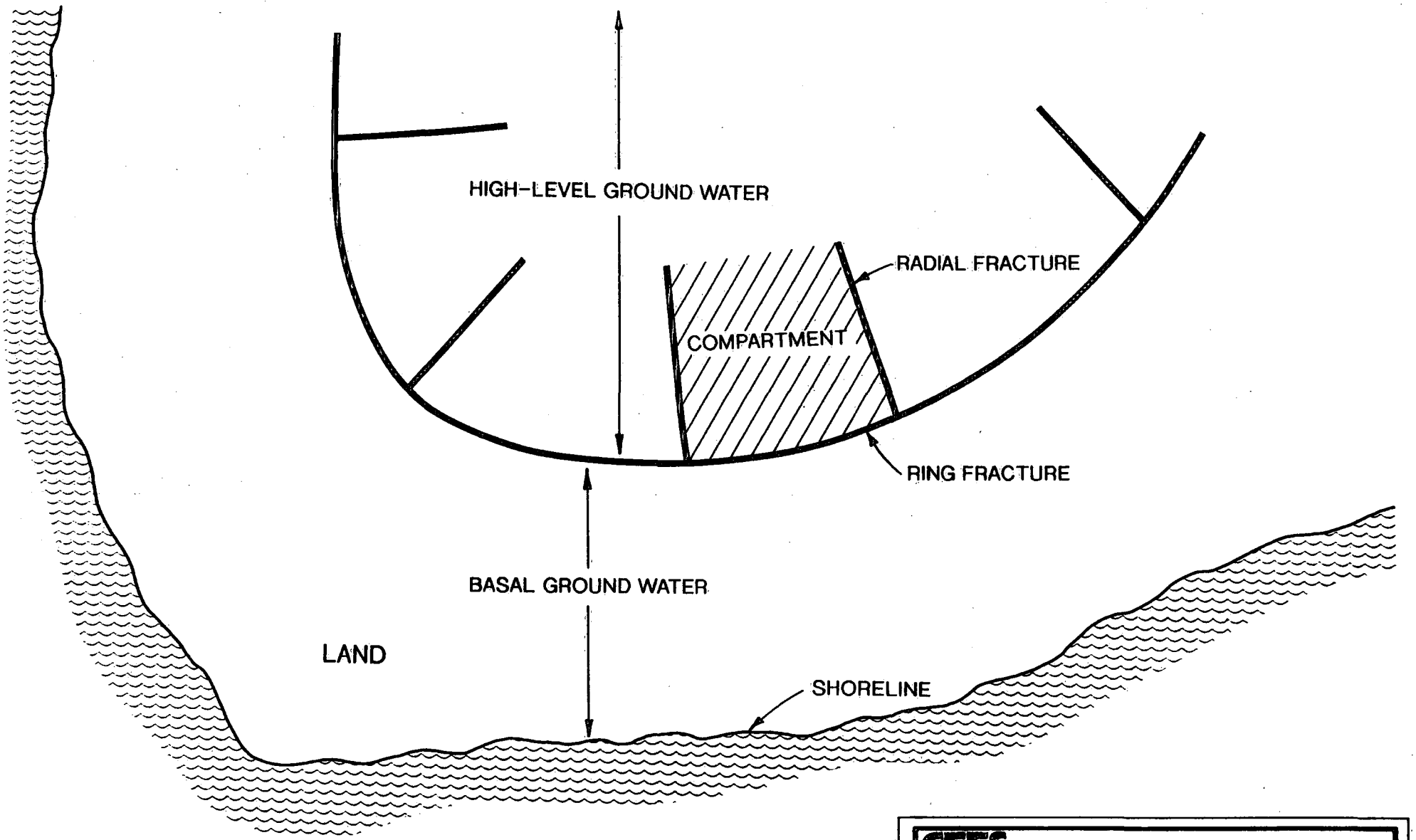
SCHEMATIC HYDROGEOLOGIC CROSS SECTION

LANAI WATER COMPANY, INC.
ISLAND OF LANAI, HAWAII

PROJECT NO. 9081-000 FIGURE 1-2



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PLAN VIEW OF SCHEMATIC GEOLOGIC MODEL OF RING AND RADIAL FRACTURE PATTERNS IN A CALDERA SYSTEM

LANAI WATER COMPANY, INC.
ISLAND OF LANAI, HAWAII

PROJECT NO. 9081-000 FIGURE 1-3

2.0 Data Acquisition and Logistics

The TDEM surveys for the Phase II project were performed by a four-man crew, consisting of two CEES-BGD geophysicists and two field helpers provided by LWCI. The locations of the TDEM soundings and existing water wells for the entire island along with cultural features (e.g., pipelines) are shown on Figure 1-1. Sounding measurements were positioned in all cases to obtain optimum data coverage and were located to avoid the existing power lines and pipelines which are known to affect TDEM data quality. A daily log of field activities is given in Table 2-1. During the course of the survey, daily communication was made with either LWCI's representative or their consulting hydrogeologist to discuss the TDEM results and to determine direction for the survey. A total of 50 soundings were taken at selected sites during the twenty-one field days.

TDEM measurements were acquired using a central-loop sounding configuration. With this type of configuration, TDEM data are recorded with a receiver coil at the center of a square transmitter loop laid on the ground surface. The transmitter loops are constructed using 12-gauge insulated copper wire. The dimensions of the transmitter loops vary, depending upon the exploration depth required at each data site (larger loop dimensions are used for deeper exploration depth). Transmitter loop sizes varied from 500 ft by 500 ft to 2,000 ft by 2,000 ft throughout the project area. Sounding location and elevation control was based on compass and hip chain measurements from known landmarks (i.e., road junctions, drill holes). Periodic altimeter measurements and checks to known elevations from the field map were made several times each day. During the helicopter surveys, the elevations were checked against the altimeter onboard to known elevations on the ground.

The geophysical equipment utilized for the TDEM surveys was the Geonics EM37 system. The system basically consists of a transmitter and receiver. A transmitter current between 10 and 25 amperes was used with base frequencies of 3 Hz and 30 Hz. At the center of each transmitter loop the time derivative of the vertical magnetic field was recorded with receiver coils with effective areas of 100 m^2 and 1,000 m^2. The field data from each sounding was stored in an Omnidata polycorder with solid state memory, and subsequently transferred to a PC-486 for nightly processing. A series of two to four additional offset (quality control) measurements symmetric about the loop center were also made at each sounding site to test for effects of inductive noise due to coupling with metallic features such as pipelines and power lines.

Data quality was excellent due to efforts made in the field in positioning the soundings away from the potential cultural noise sources (i.e., pipelines). The results from all soundings were useable, with the exception of LC39 which was distorted by an unknown source.

Table 2-1. Daily Log of Field Activities

Date (1994)	Activity
October 20 and 21	Pack and ship geophysical equipment from Golden, CO to Lanai City, HI.
October 25	Mobilize CEES-BGD crew from Golden, CO to Lanai City, HI. Meet LWCI field representatives at airport and pick up TDEM survey equipment from air cargo.
October 26	Meet Mr. Bagoyo and Mr. Nance at LWCI office to discuss scope of Phase II TDEM surveys. Unpack and organize geophysical equipment into field vehicles. Decision is made by LWCI to proceed with the TDEM survey along the west side of the island. Acquire data on Sounding LC1.
October 27	Continue data acquisition on Soundings LC2 and LC3, and layout transmitter loop for LC4.
October 28	Take data on Sounding LC4 and download to PC after acquisition. Read data on Soundings LC5 and LC6 and layout part of Loop LC7. Experience data logger problems when downloading data to PC in the PM. Unable to recover data from Soundings LC5 and LC6. Discuss TDEM results with Mr. Nance in PM.
October 29	Acquire data on Sounding LC7. Return to Sounding LC6 site and repeat measurements. Take data on Sounding LC8, north of Garden of the Gods.
October 30	Continue to take data near Garden of the Gods, on Soundings LC9, LC10 and LC11.
October 31	Relay transmitter loop on LC5 and retake data. Acquire data on Soundings LC12 and LC13.
November 1	Move to north side of island and take data on Soundings LC14 and LC15.
November 2	Read data on Sounding LC16. Move west of Garden of the Gods and take measurements on LC17. Acquire data on Sounding LC18, north of Lanai City.
November 3	Continue to take data on the north side of the island on Soundings LC19, LC20 and LC21.
November 4	Move to the southeast side of island (Puu Manu area) and acquire data on Soundings LC22 and LC23.
November 5	Read data on Soundings LC24, LC25 and LC26 along Awehi Road.
November 6	Take data on Soundings LC27 and LC28.

Table 2-1 (Continued)

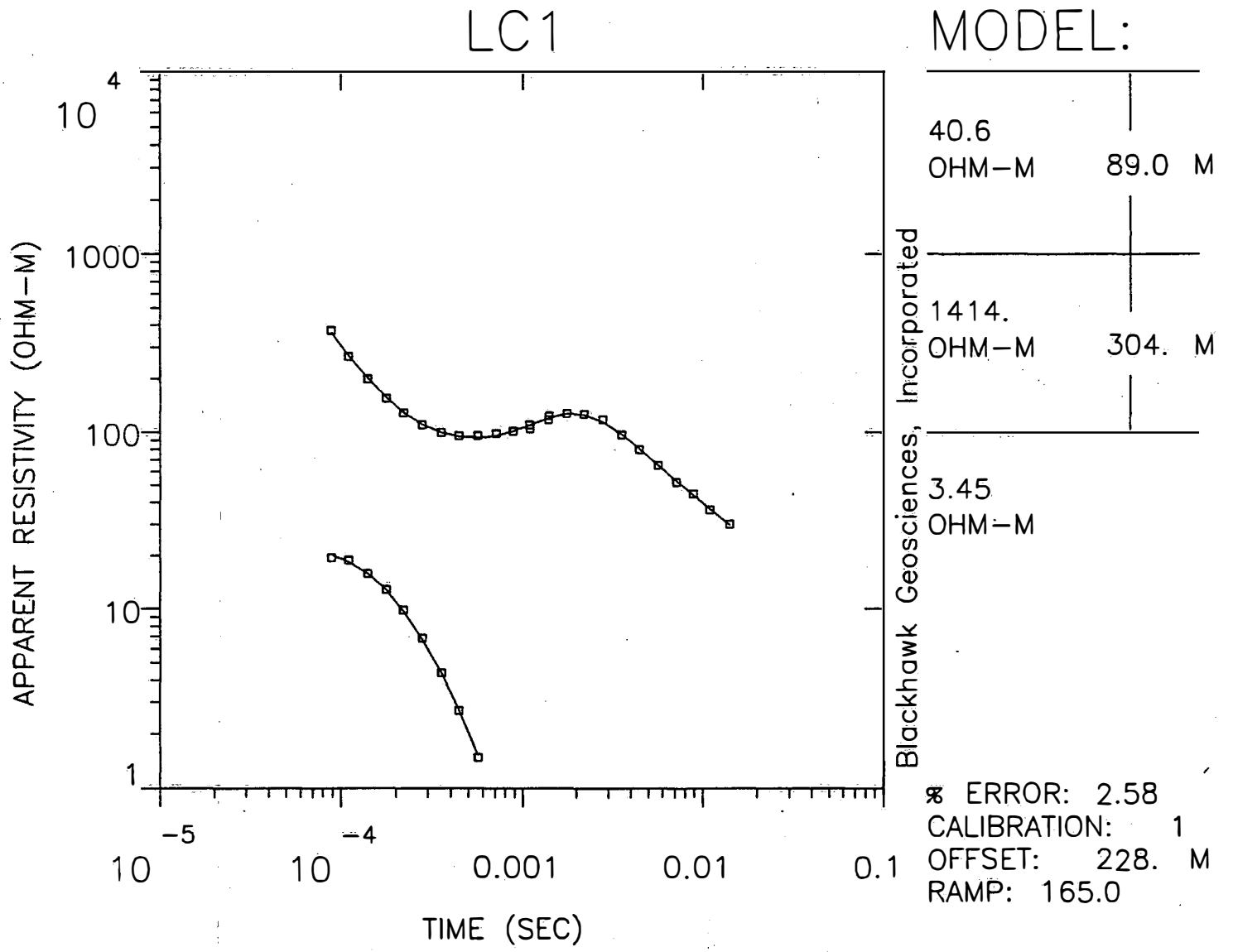
November 7	Start remote TDEM site locations with helicopter support. Fly reconnaissance of several sites to check access. Acquire data on Soundings LC29, LC30 and layout loop on LC31.
November 8	Continue helicopter support. Read data on Soundings LC31, LC32 and LC33.
November 9	Take data on Soundings LC34, LC35 and LC36 with helicopter support.
November 10	Acquire data on Soundings LC37, LC38 and layout part of loop for LC39 with helicopter support.
November 11	Read data on Sounding LC39. Fly equipment and crew out of remote site in PM and load into field vehicles. Continue data acquisition on LC40.
November 12	Take data on Soundings LC41 and LC42.
November 13	Read data on Sounding LC43 (2000 ft x 2000 ft loop) near Well 5. Move north of Lanai City and read data on Sounding LC44. Perform reconnaissance for sites LC45 and LC46.
November 14	Acquire data on Soundings LC45, LC46 and LC47.
November 15	Read data on large loop (2000 ft x 2000 ft) for Sounding LC48. Move northwest of Garden of the Gods and take data on Soundings LC49 and LC50. Last day of field work.
November 16 and 17	Demobilize equipment and crew from Lanai City, HI to Golden, CO.

3.0 Data Processing

The first step in processing TDEM data is to average the electromotive forces (emf's) recorded at opposite receiver polarities from the center of the sounding loop. Next, the recordings made at different amplifier gains and frequencies (both 3 Hz and 30 Hz) were combined to give one transient decay. The emf's of the selected time gates of the decay curves are subsequently entered into a ridge regression inversion program to obtain a one-dimensional (1-D) geoelectric section that best matches the observed decay curve.

The inversion program requires an initial model input with resistivities and layers for the geoelectric section. This model is usually derived from approximate matching of apparent resistivity curves with model curves from a series of albums of model curves or from a knowledge of the geoelectric section obtained from the site geology and drill holes. The inversion program is then allowed to adjust the model to improve the fit. This involves the adjustment of resistivities and thicknesses of the layers within the geoelectric model. The inversion program does not change the total number of layers within the model but all other parameters float freely, or optionally can be held constant. To determine the influence of number of layers on the solution, separate inversions with a different number of layers are run.

An example of the output of the inversion program for Sounding LC1 is given in Figure 3-1. The measured data points (in terms of apparent resistivity) are superimposed on a solid line. The solid line represents the computed forward model for the geoelectric section shown on the right. This geoelectric section is the best match obtained by the inversion program. In Figure 3-2, the tabulated inversion parameters consisting of measured data, computed data for best match solution, and inversion error are given. The geoelectric section in turn is translated into hydrogeologic information by establishing a relationship between resistivity and hydrogeologic units. The principles of TDEM are explained in Appendix A. Inversion plots and tables for all 98 soundings from both 1994 surveys and the 1993 survey are given in Appendix B.



CEES BLACKHAWK GEOSCIENCES DIVISION

SAMPLE DATA SET SOUNDING LC 1

LANAI WATER COMPANY, INC.
ISLAND OF LANAI, HAWAII

PROJECT NO. 9081-000 FIGURE 3-1

LC1

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		360.0	1181.0		
40.63	89.0	271.0	889.1	2.2	2.2
1413.91	304.1	-33.1	-108.6	0.2	2.4
3.45					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	3.72E+02	3.62E+02	2.780	
2	1.10E-04	2.66E+02	2.70E+02	-1.394	
3	1.40E-04	1.99E+02	2.00E+02	-0.504	
4	1.77E-04	1.55E+02	1.57E+02	-1.006	
5	2.20E-04	1.29E+02	1.30E+02	-0.721	
6	2.80E-04	1.10E+02	1.11E+02	-0.846	
7	3.55E-04	9.96E+01	9.97E+01	-0.075	
8	4.43E-04	9.52E+01	9.44E+01	0.926	
9	5.64E-04	9.50E+01	9.30E+01	2.157	
10	7.13E-04	9.83E+01	9.57E+01	2.716	
11	8.81E-04	1.01E+02	1.01E+02	-0.302	
12	8.90E-04	1.01E+02	1.02E+02	-0.449	
13	1.10E-03	1.10E+02	1.09E+02	0.301	
14	1.10E-03	1.04E+02	1.10E+02	-4.870	
15	1.40E-03	1.17E+02	1.20E+02	-2.010	
16	1.41E-03	1.23E+02	1.20E+02	2.598	
17	1.77E-03	1.27E+02	1.27E+02	0.366	
18	2.20E-03	1.27E+02	1.26E+02	0.852	
19	2.80E-03	1.17E+02	1.14E+02	2.598	
20	3.55E-03	9.61E+01	9.71E+01	-0.964	
21	4.43E-03	7.99E+01	8.07E+01	-1.005	
22	5.64E-03	6.51E+01	6.52E+01	-0.061	
23	7.13E-03	5.23E+01	5.29E+01	-1.108	
24	8.81E-03	4.46E+01	4.40E+01	1.493	
25	1.10E-02	3.62E+01	3.66E+01	-0.920	
26	1.41E-02	3.00E+01	2.98E+01	0.691	

R: 228. X: 0. Y: 229. DL: 457. REQ: 254. CF: 1.0000
CLHZ ARRAY, 26 DATA POINTS, RAMP: 165.0 MICROSEC, DATA: LC1
2610 LC 100NZ OPR XTL L 6 10-100
Ch.21 = 0.165 Ch.22 = 0.89 Ch.23 = 11 Ch.24 = 2
RMS LOG ERROR: 1.10E-02, ANTILOG YIELDS 2.5765 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	1.00				
P 2	0.00	0.07			
P 3	0.00	-0.01	0.99		
T 1	0.00	-0.02	0.00	1.00	
T 2	0.00	0.01	0.00	0.00	1.00

P 1 P 2 P 3 T 1 T 2

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	37.616	40.631	43.501
	2	645.487	1413.908	5821.958
	3	2.874	3.449	4.138
THICK	1	78.647	88.982	99.258
	2	295.951	304.088	313.551
DEPTH	1	78.647	88.982	99.258
	2	391.087	393.070	395.209

CEES BLACKHAWK GEOSCIENCES DIVISION

SAMPLE DATA SET
SOUNDING LC 1

LANAI WATER COMPANY, INC.
ISLAND OF LANAI, HAWAII

PROJECT NO. 9081-000 FIGURE 3-2

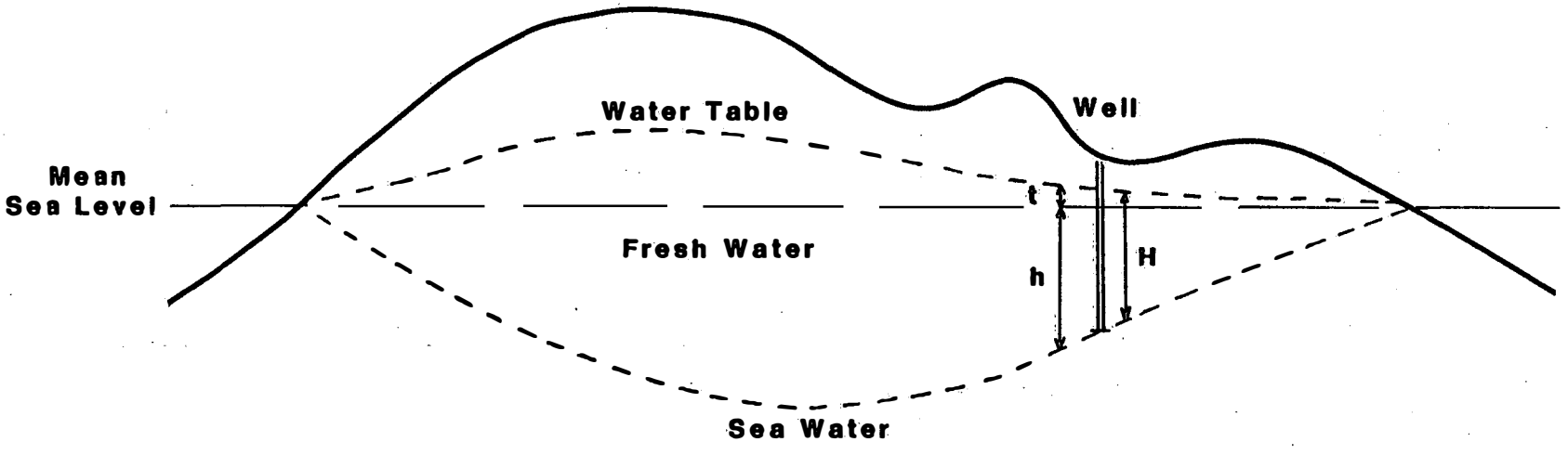
4.0 Hydrogeologic Setting

General

Ground water is expected in the basal mode, resting nearly at sea level near the ocean surrounding the Island of Lanai. This is mainly due to the fact that the volcanic rocks which comprise the island allow rainfall to percolate with little impedance directly downward through the island mass (Ref. Fig. 1-2). The fresh water is assumed to float upon the salt water encroaching from the ocean. Fresh water flows laterally towards the ocean causing the fresh water lens to be thinner towards the ocean. When ground water is under conditions of static equilibrium, the Ghyben-Herzberg Principle (see Fig. 4-1) states that for every one foot of fresh water above sea level, approximately 40 ft of fresh water will exist below sea level. While at static equilibrium, the transition from fresh water to sea water is generally quite sharp. Further inland, the ground water is expected to be controlled by damming structures (e.g., dikes) and if conditions are right, high-level ground water occurrences may result.

The Island of Lanai is geologically complex, with a collapsed caldera structure (Palawai Basin) located in the south-central portion of the island (ref. Fig. 1-1). The southern rim of the caldera is expected approximately parallel to the 1,200 ft (365 m) elevation level in the Palawai Basin Area, with numerous northwest-southeast trending dikes and faults away from the caldera feature (Stearns, 1936). Concentric patterns of dikes and faults are also postulated to emanate away from the collapsed caldera in the basin area. Wells 1, 9 and 10 are located approximately within the rim of the Palawai Basin caldera. Well 10 is at surface elevation 1,240 ft (378 m) and it is reported to have a static water level of 210 ft (head). The water in this well has a bottom hole temperature of 112°F at a depth of 225 ft below msl with 2800 ppm chlorides (per comm. with T. Nance, 1994). Since this well is geothermally warm, it is expected to be within a confining geologic structure associated with the southern rim of the caldera. Well 1, located in the northern portion of Palawai Basin at elevation 1265 ft (385 m), and Well 9 at elevation 1,395 ft (425 m), both exhibit extremely high static water levels, 818 ft and 812 ft head, respectively. The water at the bottom of these two wells is slightly geothermal (> 90°F) and they may be in separate confining geologic structures within the northern portion of the basin. The Manele Well is at about the 180 ft (55 m) elevation, north of the Manele Bay Hotel, has 1.1 ft head, and the ground water is in the basal mode. From the 1993 TDEM survey data in the Manele Bay Hotel area, a ground water barrier is inferred to exist between the Manele Well and Well 10 at the approximate 650 ft (205 m) elevation level. On the eastern side of the Palawai Basin an approximate north-south trending rift zone is expected. Within rift zones, dikes and dike complexes of impermeable rocks can provide a barrier to ground water flow and this can result in high-level ground water and discontinuities in hydraulic gradients. Wells 12 and 13 are located within the South Rift Zone and show moderate fresh/brackish water static levels of 5 ft head. Recently, Well 12 has been used as a production well.

Along the Windward Coast of Lanai, the boundary between basal and high-level ground water occurs further inland than in the Palawai Basin area. Therefore, ground water in this area may be contained in the basal mode over a larger areal extent. Within the trend of the Northwest Rift Zone, faulting and diking also occurs and barriers to ground water flow can produce compartments of high-level ground water.



$t = 1/40\ (h)$

FROM: HERZBERG

CES BLACKHAWK GEOSCIENCES DIVISION

Illustration of the
Ghyben-Herzberg Principle

LANAI WATER COMPANY, INC
ISLAND OF LANAI, HAWAII

PROJECT NO. 9081-000 FIGURE 4-1

5.0 Results and Interpretation

General

From TDEM soundings, the subsurface resistivity layering (geoelectric section) is derived. A brief technical note describing the principles of TDEM is given in Appendix A. The translation of resistivity layering into hydrologic information is generally accomplished by two methods:

1. One method is to use available knowledge about the relation between resistivity values and local site hydrology. Using information from more than twenty-five previous TDEM surveys on the Hawaiian Islands, it has been observed that dry and fresh water saturated volcanics exhibit high resistivities, typically greater than 500 ohm-m. Conversely, volcanic rocks that are saturated with salt water exhibit resistivities typically less than 5 ohm-m. Weathered volcanics or ash flows and intrusives often exhibit intermediate resistivities (10 to 100 ohm-m). Using this knowledge, characteristic ranges of subsurface resistivities expected for local hydrogeologic units are shown in Figure 5-1. It should be recognized that some overlap in resistivities occur, but other factors are also used to infer the geologic/hydrologic formation in question. For example, a low resistivity unit (e.g., less than 10 ohm-m) occurring at an elevation above sea level is assumed to be caused by either intrusive units or weathered rock formations rather than salt water saturated units. Soundings which are interpreted to be located within the postulated caldera rim (Palawai Basin) may be influenced by lateral lithologic changes. In addition, alteration of the volcanics by geothermal waters is expected to decrease the bulk formation resistivity.

2. Another method is to calibrate the geophysical interpretation at wells. In the Palawai Basin area, four wells were available for comparison with the TDEM survey interpretations. Several wells near Lanai City and at higher elevations above the Palawai Basin were also available for comparison. Well information was not available for comparison in the vicinity of the Northwest Rift Zone or Windward Coast areas.

During the Phase II ground water study on Lanai, a total of 50 additional TDEM sounding measurements were acquired across the entire island. The locations of the soundings taken during the present study, and all previous surveys on the island, have been incorporated into this data set and they are shown on Figure 1-1. A total of eight geoelectric cross sections were constructed from the results of the TDEM interpretations.

Geoelectric Cross Section A-A'

Figure 5-2 shows the results of four TDEM soundings presented as a south to north trending geoelectric cross section (A-A') in which layers with similar resistivity values have been linked together. The cross section is in the northwestern portion of the island centered near the Garden of the Gods.

The upper layer of the cross section exhibits resistivity values ranging from 27 to 78 ohm-meters. This layer is interpreted to represent the laterite soil across the top of the island. The laterite unit has been modeled with the greatest thickness along this cross section to be about

391 ft thick at Sounding LC9. The second layer in the section, below all soundings, is a high resistivity layer ranging from 449 ohm-meters to greater than 5000 ohm-meters. The maximum thickness of this layer (1358') is found below Sounding LC9. This second layer is interpreted to represent dry unweathered volcanic rock above sea level and where it occurs below sea level it is expected to be saturated with fresh/brackish basal mode ground water. The lower layer beneath Soundings LC8, LC10 and LC49 with resistivities less than 5 ohm-meters is interpreted to represent salt water saturated volcanics. The fresh/brackish water lens is interpreted to be maximum at Sounding LC8 with a thickness of 107 feet.

Sounding LC9 is interpreted to be bounded by an inferred geologic/hydrologic discontinuity (ground water damming structure) where the salt water interface is not interpreted to exist. The intermediate resistivity of the lower layer in this sounding (10.5 ohm-m) is expected to be caused by influences form lateral discontinuities (e.g., dikes, faults) or from altered volcanics. The interpreted resistivity stratification from Sounding LC9 may not represent true formation resistivities due to possible distortion from 2-dimensional geologic/geoelectric structures in the vicinity of the sounding. The position and width of the ground water damming structures are uncertain, and they have been placed midway between Soundings LC10 and LC9, and midway between Soundings LC8 and LC9.

Geoelectric Cross Section B-B'

The geoelectric cross section for B-B' is shown in Figure 5-3. The cross section data starts on the west coast north of Honopu Bay and trends from south to north. This cross section was presented in the geophysical report from the survey of August 1994. The following is the direct interpretation from that report.

Beneath Soundings NWRZ3, NWRZ4, and NWRZ5, the lower layer exhibits resistivity values ranging from 2.6 to 4.7 ohm-m, which is interpreted to represent salt water saturated volcanics. The upper layer in the cross section, with resistivities ranging from 343 ohm-meters to 2498 ohm-meters, is interpreted to represent dry unweathered volcanics above sea level and where it occurs below sea level, it is expected to be saturated with fresh/brackish basal mode water. The approximate thickness of the fresh/brackish water lens is expected to be greatest (292') beneath Sounding NWRZ4.

Beneath Soundings NWRZ1 and NWRZ2 a salt water interface is not interpreted. Instead, intermediate resistivity values (16 to 33 ohm-meters) are exhibited from 740 ft to 780 ft below msl. Lateral discontinuities (e.g., faults, dikes) are expected to occur between Soundings NWRZ1 to NWRZ4 and between Soundings NWRZ2 and NWRZ3 because of rapid lateral variation in resistivities between these two sets of soundings. From the cross section, the approximate location of the hydrogeologic boundary is placed between Sounding NWRZ1 and NWRZ4 on the north side of the island and between NWRZ2 and NWRZ4 on the south side of the island. Since the salt water interface was not interpreted beneath NWRZ1 and NWRZ2, the elevation of the water table cannot be estimated. The potential for high-level water is expected in the vicinity of these two soundings as they are interpreted to be above the interpreted geologic/hydrologic ground water damming structure.

Geoelectric Cross Section C-C'

Figure 5-4 exhibits the results along cross-section C-C'. This cross section includes data from the August 1994 survey and the October-November 1994 survey. Cross-section C-C' begins near Naupaka on the west coast of the island and trends northeasterly towards the Auau Channel at Kahokunui.

With the exception of Sounding L2S3 and Sounding L2S1, the upper layer is interpreted to be laterite soil with resistivities ranging from 40 to 60 ohm-meters. Sounding L2S3 has a surface layer with a resistive layer modeled at 377 ohm-meters, and a thickness of 114 ft. This layer is interpreted to represent a unit of unweathered volcanic rock. The second layer has a modeled resistivity of 33 ohm-meters (116 ft thick) which is interpreted to represent weathered volcanics. Sounding L2S1 is a two-layer model with the upper layer (161 ohm-meters) interpreted to be dry unweathered volcanics.

The resistive layer beneath Soundings LC5, LC2 and LC6 on the west portion of the cross section, and Soundings L2S3, LC21, L2S2 and L2S1 on the northeastern end of the section represents dry unweathered volcanics above sea level. Sounding LC5 on the west end of the cross section, and L2S2 and L2S1 on the northeast end of the cross section show the lower layer (resistivities > 5 ohm-meters) to be representative of salt water saturated volcanics. Basal mode ground water is interpreted beneath these three soundings, and the thickest lens of fresh/brackish water is expected to be below Sounding LC5 with a calculated thickness of 113 feet.

The interpreted geologic/hydrologic ground water damming structure is interpreted to be beneath Soundings LC2 and LC6 on the west end of the cross section and between Soundings LC21 and L2S2 on the northeastern portion of the cross section. Intermediate resistivity layers, near or below sea level, ranging from 19 to 38 ohm-meters are modeled in these soundings. The results of these soundings may be distorted by 2-dimensional geologic/geoelectric structures.

Potential high-level ground water is interpreted to be present midway between Soundings LC6 and LC18 on the west portion of the cross section and continuing to a point midway between Soundings LC21 and L2S2 on the northeastern end of the cross section. Soundings LC18, L2S3 and LC21 exhibit highly resistive layers to depths well below sea level.

Geoelectric Cross Section D-D'

Geoelectric cross-section D-D' is shown on Figure 5-5. This cross section starts on the west coast of the island near Keil Bay, passes north of Lanai City, through Well 6, and onto the northeast side of the island at the Auau Channel near Kaikena. Between Well 6 and Sounding LC35, the cross section intersects Maunalai Gulch, and between Soundings LC33 and LC34 the cross section intersects Hauola Gulch.

Cross-section D-D' is modeled with a 41 to 56 ohm-meter surface layer on the west portion of the cross section with a maximum interpreted thickness of 482 ft at Sounding LC44. Sounding LC35 on the northeastern side of the cross section shows a thin (32'), 14 ohm-meter at the surface, while Soundings LC33 and LC34 are modeled with a highly resistive surface layer.

Basal mode ground water is interpreted to exist below Sounding LC1 on the west portion of the cross section and at Sounding LC34 on the northeast end of the cross section. The lower layer resistivity for these soundings are 3.5 ohm-meters and 1.6 ohm-meters respectively. Sounding LC1 indicates the thickest lens of fresh/brackish water along this cross section with a calculated thickness of 111 feet.

A geologic/hydrologic discontinuity, is interpreted to be present below Sounding LC45 on the west side of the cross section and below Sounding LC33 on the northeast portion of the cross section. The position and width of the discontinuity is uncertain, but is interpreted to be between Soundings LC1 and LC44 on the west portion of the cross section and between Soundings LC35 and LC34 on the eastern portion of the cross section. Layer resistivities and thicknesses are expected to be distorted by 2-dimensional geologic/geoelectric structures.

Between Soundings LC44 and LC45 potential high-level ground water is interpreted to be present, and continue through the island to a point between Soundings LC33 and LC35. This interpretation is justified by the modeled, highly resistive layer extending below sea level at Soundings LC44 and LC35. Well 6, a high-level well (measured head of 1000 ft.) is located approximately midway between Soundings LC44 and LC35.

Geoelectric Cross Section E-E'

Geoelectric cross-section E-E' is shown on Figure 5-6. This cross section extends from Kaumalapali Harbor on the west coast through the Palawai Basin, and continues over the highest elevations of the island near Lanai Hale and continues to Halepalaoa Landing on the east coast of the island (near Club Lana'i).

The surface intermediate resistivity (23 to 54 ohm-meters) is interpreted to be a lateritic soil between Soundings PB11 and PB8, and at Soundings LC37 and L1S3. The thickest portion of the lateritic soil is located at Sounding PB4 and is interpreted to be 290 ft. The second layer in the cross section, below all soundings is exhibited by resistivities ranging from 147 ohm-meters to greater than 5000 ohm-meters. This layer is interpreted to represent dry unweathered volcanic rock above sea level, and where it occurs below sea level, the layer is expected to be saturated with fresh/brackish basal mode water.

Soundings PB11 and PB4 on the west side of the cross section, and Soundings L1S3, L1S2 and L1S1 on the east side of the cross section exhibit resistivities of the lower layer ranging from 1.9 ohm-meters to 3.4 ohm-meters all at depths below sea level. The lower layer resistivities are representative of salt water saturated volcanics and therefore basal mode ground water is expected to occur beneath these soundings. The fresh/brackish water lens is expected to be thickest near Sounding L1S3 and is calculated to be 118 feet.

Sounding PB12 on the west portion of the cross section and Sounding L1S4 on the east portion of the cross section are interpreted to be within a geologic/hydrologic discontinuity. Both soundings exhibit intermediate resistivities at depth indicative of the type of sounding within the discontinuity. Sounding results within this region may be distorted by 2-dimensional geologic/geoelectric structures.

Potential high-level ground water is interpreted to exist between Soundings PB12 and PB8 and extends across the center of the island to a point between Soundings LC37 and L1S4. Soundings within this region have a resistivity layer that extends several hundred feet below mean sea level (msl). For example, Sounding PB8, southwest of high-level Well 9 (head = 812 ft), has a second layer resistivity of 218 ohm-meters extending from 1214 ft above msl to 316 ft below msl. Sounding LC48, south of Well 2 (head = 1500 ft), has a second layer resistivity of 315 ohm-meters from 1416 ft above msl and extends to 197 ft below msl. Other wells near the cross section, Well 1 (head = 818 ft) and Well 4 (head = 1500 ft), are also high-level ground water wells.

Geoelectric Cross Section F-F'

Geoelectric cross-section F-F' is shown as Figure 5-7. The cross section extends from the west coast of the island near Kahilikalani, along the approximate location of the southwest rift zone, through the Palawai Basin, continues over the top of the island and follows along the Awehi road to Kapua on the southeast side of the island.

All soundings on the west side of the island along cross section F-F' are interpreted to contain a lateritic soil at the surface with resistivities ranging from 30 to 76 ohm-meters and a thickness of 423 ft (at Sounding LC43). Soundings LC24, LC25 and LC26, on the east side of the island, have a high resistivity surface layer interpreted to be dry unweathered volcanics.

Sounding PB17 on the west side of the island and Soundings LC25 and LC26 on the east side of the island have a lower layer resistivity ranging from 1.3 to 2.5 ohm-meters. These soundings indicate the presence of basal mode ground water. The fresh/brackish water lens is calculated to be thickest at Sounding PB17 (223 ft).

Sounding PB3 on the west end of the cross section and Sounding LC24 on the east side of the island are interpreted to be within the inferred geologic/hydrologic discontinuity. The results of these soundings may be distorted by 2-dimensional geologic/geoelectric structures.

The area between Soundings PB2 and PB3 and extending between Soundings LC27 and LC24 is interpreted to be within the area of potential high-level ground water. Sounding PB6, south of Well 1 (head = 818 ft), shows a resistive layer from about 1000 ft above msl to over 1000 ft below msl, indicative of the resistivity values and thicknesses interpreted to be within the potential high-level ground water environment. Sounding LC43 also indicates a highly resistive second layer from 1566 feet above msl to 139 feet below msl. This sounding is located south of high-level Well 5 (head = 1510 ft).

Geoelectric Cross Section G-G'

Figure 5-8 displays the geoelectric cross-section for G-G'. This cross section originates on the southern shore of the island near Anapuka and heads north toward Well 10, continues toward the east on the extreme southern edge of the Palawai Basin, passes over Puu Manu and trends toward the southeast portion of the island near Kamaiki Point.

Surface lateritic soils (resistivities between 22 and 55 ohm-meters) are interpreted and present beneath the area of Soundings PB5, PB19, LC40 and LC28. The lateritic soil is likely not continuous along this cross section because it is positioned near the edge of the Palawai Basin. The maximum thickness (325') of the layer is expected to be present at Sounding PB19.

A resistive layer ranging from 120 to greater than 5000 ohm-meters is present in all soundings along the cross section. Where this high resistivity layer is found above sea level, it is interpreted to be dry unweathered volcanic rock, and where present below sea level it is expected to be fresh/brackish water saturated volcanics.

Sounding PB16 on the west end of the cross section and Sounding LC23 on the east side of the cross section contain a layer of low resistivity (less than 5 ohm-meters) below sea level and are interpreted to be within the area where a fresh/brackish water lens is present. Sounding LC23 likely contains the greatest thickness of the lens, calculated to be 176 ft.

Sounding PB14 on the west side of the cross section and Sounding LC22 on the east side of the island are interpreted to be within the geologic/hydrologic discontinuity. Sounding results within this discontinuity may be distorted by 2-dimensional geologic/geoelectric structures.

The area between Soundings PB5 and PB14 on the west side of the cross section and continuing toward the east between Soundings LC28 and LC22 on the east end of the cross section is interpreted to have potential high-level ground water. A high resistivity layer that extends well below sea level is modeled for the soundings within this region. Well 10 (head = 210 ft), a high-level well, is located south of Sounding PB5 which has a second layer resistivity of 238 ohm-meters that extends from 912 ft above msl to 361 ft below msl.

Geoelectric Cross Section H-H'

Geoelectric cross-section H-H' is shown in Figure 5-9. The cross section extends from Hulopoe Bay on the south shore, through the Palawai Basin, past Lanai City, and extends toward the north side of the island.

The upper layer is interpreted to be lateritic soils with resistivities ranging from 33 to 84 ohm-meters which is present throughout the cross section with the exception of Soundings 1, 4, and 6 of the Line 1 1993 data. The maximum modeled thickness of this lateritic soil is expected to be at Sounding LC44, and is calculated to be 482 feet. A resistive layer ranging from 165 to 2077 ohm-meters, is present throughout the cross section and is interpreted to be dry unweathered volcanic rock above sea level and fresh/brackish water saturated volcanics if present below sea level.

Soundings 1, 2 and 3 of the Line 1 1993 data on the south end of the cross section and Sounding LC16 on the north end of the cross section have a lower layer resistivity range of 1.7 to 2.9 ohm-meters found below sea level. These soundings are interpreted to have basal mode ground water. The thickest lens of fresh/brackish water is calculated to be at LC16 where it is 225 ft.

Soundings 4 and 5 of Line 1 1993 data on the south end of the cross section and an area between LC15 and LC16 on the north end of the cross section are expected to be within the inferred geologic/hydrologic discontinuity. The TDEM sounding results from these areas may be distorted by 2-dimensional geologic/geoelectric structures.

The area between Soundings 5 and 6 of the Line 1, 1993 data, and extending to the north between Soundings LC15 and LC16 on the north end of the cross section, is interpreted to be an area where potential high-level ground water may exist. Three high-level wells are near the position of the cross section within the interpreted potential high-level ground water area. They include Well 1 (head = 818 ft), Well 9 (head = 812 ft), and Well 7 (head = 680 ft) and they have been incorporated into the cross section.

Hydrogeologic Interpretations

The results of the TDEM soundings from the study areas encompassing the entire island are further summarized in Table 5-1 and on the Interpretation Summary Map shown in Figure 5-10. In Table 5-1 the thicknesses of the fresh/brackish water lens calculated from the elevation of the salt water interface are listed. These values have been interpreted from the individual TDEM sounding measurements. The table does not include the value of head which can be calculated by using the Ghyben-Herzberg Principle. In Figure 5-10 the interpretation of the TDEM soundings are separated into three distinctly different groups, and they are marked by a color code. The results from the TDEM soundings show:

1. A series of soundings beneath which a layer of low resistivity (less than 5 ohm-m) was detected below msl (blue). A fresh/brackish water lens is expected to exist in the basal mode beneath these soundings. Basal ground water exists around the perimeter of the entire island. The areal extent of the basal ground water is interpreted to be narrowest (approximate 4000 ft from the coast line to the inland extent of the boundary) near the Manele Bay Hotel, on the south side of the island. In this area the thickness of the lens floating on salt water is expected to be thin and to be about 46 ft at Sounding 2, Line 1. The maximum inland extent of the basal boundary is shown to exist on the northwest portion of the island near the Garden of the Gods. In this area the inland extent of the boundary is approximately 20,000 ft (3.8 miles) from the coast line. The thickest lens of fresh/brackish water is interpreted to exist beneath Soundings LC16 (219 ft) and NWR24 (292 ft) in the northern portion of the island.

2. A group of soundings in which measured resistivities are interpreted to be influenced by lateral discontinuities and geologic/hydrologic ground water damming structures are inferred (green). In these areas intermediate resistivity values (15 to 70 ohm-meters) are interpreted to occur both above and below sea level. The TDEM data for these soundings may be distorted by 2-dimensional geoelectric structures (i.e., dikes) and the measured geoelectric parameters may not represent true ground resistivities. Ground water levels, production, and quality are expected to be variable in these areas. The inferred geologic/hydrologic discontinuity is interpreted to surround the island at varying elevations and with an increased width on the western side of the island (west of Lanai City).

3. Soundings in which high resistivity values (greater than 100 ohm-meters) are interpreted for an exploration depth interval which extends from several hundred feet below msl to greater than 1000 ft below msl (yellow). This area extends throughout a large portion of the center of the island. It is expected to extend beyond the Palawai Basin on the south to near the Garden of the Gods area on the northwest side, and include areas beyond the Monro Trail Road on the eastern portion of the island. Throughout these areas the potential for high-level water exists. A number of wells throughout the island substantiate these data sets.

The accuracy of determining the location of the interpreted ground water damming structures throughout the entire island study is mainly based on TDEM data density (station spacing). In areas where the distance between soundings is relatively short (less than 3000 ft), the accuracy is increased. In other areas of the island distances between soundings are much greater. Therefore, the lower (seaward) and upper (inland) hydrogeologic boundaries are interpreted to vary in elevation across the island.

Stearns, H.T., 1936. Geology and ground-water resources of Lanai and Kahoolawe, Hawaii. Division of Hydrography, Bulletin 6, pp. 22-60.

Table 5-1

Hydrogeologic Information Derived From TDEM Soundings

Year:	Sounding #	Surface Elev. (ft)	(m)	Approx. Thickness of Fresh/Brackish Water Lens (ft)	Comments
1994:	LC1	1181	360	Basal Mode Water (108)	West of Puu Koa
	LC2	1286	392	Ground Water Barrier*	West of Lanai City
	LC3	1312	400	Ground Water Barrier*	West of Lanai City
	LC4	1129	344	Basal Mode Water (145)	West of Lanai City
	LC5	1108	338	Basal Mode Water (110)	West of Lanai City
	LC6	1483	452	Ground Water Barrier*	West of Lanai City
	LC7	1473	449	Ground Water Barrier*	West of Lanai City
	LC8	1371	418	Basal Mode Water (104)	Northwest Rift Zone Trend
	LC9	1749	533	Structure Controlled	Northwest Rift Zone Trend
	LC10	1194	364	Basal Mode Water (57)	South of Garden of Gods
	LC11	1181	360	Basal Mode Water (70)	South of Garden of Gods
	LC12	1575	480	Structure Controlled	South of Northwest Rift Zone
	LC13	1260	384	Basal Mode Water (98)	Northwest Rift Zone Trend
	LC14	1738	530	Structure Controlled	South of Puu Mahana
	LC15	1568	478	Structure Controlled	North of Puu Mahana
	LC16	1161	354	Basal Mode Water (219)	North of Puu Mahana
	LC17	1033	315	Basal Mode Water (3)	Northwest Rift Zone Trend
	LC18	1489	454	Structure Controlled	West of Well 7 (680' head)
	LC19	1240	378	Basal Mode Water (185)	West of Puu Mahana
	LC20	1532	467	Ground Water Barrier*	West of Puu Mahana
	LC21	1558	475	Structure Controlled	Along Keomuku Road
	LC22	1312	400	Ground Water Barrier*	South of Puu Manu
	LC23	787	240	Basal Mode Water (172)	South of Puu Manu
	LC24	1936	590	Ground Water Barrier*	Along Awehi Road

Table 5-1 (Continued)

LC25	978	298	Basal Mode Water (166)	Along Awehi Road
LC26	564	172	Basal Mode Water (132)	Along Awehi Road
LC27	2789	850	Structure Controlled	Along Monro Trail
LC28	1936	590	Structure Controlled	On Puu Manu
LC29	804	245	Basal Mode Water (117)	Helicopter access
LC30	1624	495	Basal Mode Water (149)	Helicopter access
LC31	1952	595	Ground Water Barrier*	Helicopter access
LC32	1443	440	Structure Controlled	Helicopter access
LC33	1411	430	Ground Water Barrier*	Helicopter access
LC34	761	232	Basal Mode Water (53)	Helicopter access
LC35	1755	535	Structure Controlled	Helicopter access
LC36	1739	530	Ground Water Barrier*	Helicopter access
LC37	2346	715	Structure Controlled	Helicopter access
LC38	1607	490	Ground Water Barrier	Helicopter access
LC39	945	288	Distorted data (possible pipe)	Helicopter access (data unusable)
LC40	1594	486	Structure Controlled	West of Puu Manu
LC41	1050	320	Basal Mode Water (133)	South Rift Zone
LC42	2297	700	Structure Controlled	Along Monro Trail
LC43	1998	609	Potential High-level	South of Well 5 (1510' head)
LC44	1598	487	Potential High-level	South of Well 7 (680' head)
LC45	1516	462	Ground Water Barrier*	West of Lanai City
LC46	1526	465	Ground Water Barrier*	South of Lanai City
LC47	1309	399	Structure Controlled	Southwest of Well 5 (1510' head)
LC48	1926	587	Structure Controlled	West of Well 4 (1500' head)
LC49	1020	311	Basal Mode Water (31)	North of Garden of Gods

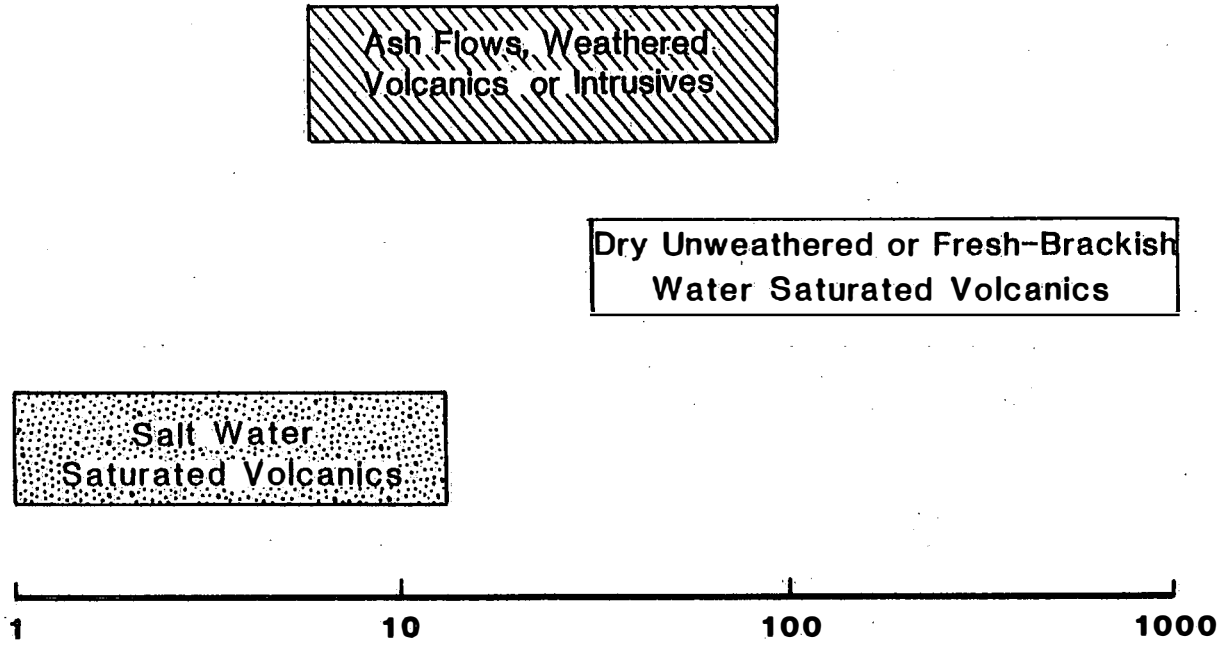
Table 5-1 (Continued)

	LC50	955 291	Basal Mode Water (114)	North of Garden of Gods
1994:	PB1	1175 358	Ground Water Barrier*	Palawai Basin Area
	PB2	1227 374	Structure Controlled	Miki Basin Area
	PB3	1283 391	Ground Water Barrier*	Southwest Rift Zone
	PB4	1194 364	Basal Mode Water (110)	West of Palawai Basin
	PB5	1194 364	Structure Controlled	North of Well 10 (210') Head
	PB6	1188 362	Structure Controlled	South of Well 1 (818') Head
	PB7	1099 335	Structure Controlled	Palawai Basin
	PB8	1286 392	Structure Controlled	Southwest of of Well 9 (812') Head
	PB9	1119 341	Structure Controlled	Palawai Basin
	PB10	1503 458	Ground Water Barrier*	East of Puu Koa
	PB11	853 260	Basal Mode Water (98)	West side of island
	PB12	1371 418	Ground Water Barrier*	North of Airport
	PB13	948 289	Basal Mode Water (74)	Southwest edge of island
	PB14	1047 319	Ground Water Barrier*	Southwest of Well 10 (210' head)
	PB15	360 110	Basal Mode Water (37)	On Manele Bay Golf Course, Hole 5
	PB16	702 214	Basal Mode Water (83)	Southwest edge of island
	PB17	1152 351	Basal Mode Water (206)	Southwest Rift Zone
	PB18	554 169	Basal Model Water (173)	South Rift Zone, at Well 12 (5') Head
	PB19	1309 399	Structure Controlled	South Rift Zone
	PB20	1237 377	Structure Controlled	South Rift Zone
	NSL1S1	180 55	Basal Mode Water (91)	Mauka Club Lanai
	NSL1S2	528 161	Basal Mode Water (115)	Mauka Club Lanai
	NSL1S3	1024 312	Basal Mode Water (188)	Mauka Club Lanai
	NSL1S4	1329 405	Ground Water Barrier*	Mauka Puu Nene

Table 5-1 (Continued)

	NSL2S1	387	118	Basal Mode Water (62)	Along Keomuku Road
	NSL2S2	1066	325	Basal Mode Water (96)	Along Keomuku Road
	NSL2S3	1821	555	Structure Controlled	Along Keomuku Road
	NSL3S1	1201	366	Ground Water Barrier*	Above Maunalei Gulch
	NSL3S2	804	245	Basal Mode Water (85)	Makia Wawaeku
	NSL4S1	1115	340	Basal Mode Water (171)	Windward Coast
	NWRZ1	1667	508	Structure Controlled	Northwest Rift Zone
	NWRZ2	1663	507	Structure Conrolled	Northwest Rift Zone
	NWRZ3	1115	340	Basal Mode Water (190)	South of Northwest Rift Zone
	NWRZ4	1345	410	Basal Mode Water (292)	North of Northwest Rift Zone
	NWRZ5	807	246	Basal Mode Water (87)	North of Northwest Rift Zone
1993:	L1S1	246	75	Basal Mode Water (40)	Along Manele Road
	L1S2	394	120	Basal Mode Water (46)	Along Manele Road
	L1S3	508	155	Basal Mode Water (36)	Along Manele Road
	L1S4	720	219	Ground Water Barrier*	Along Manele Road
	L1S5	886	270	Ground Water Barrier*	Along Manele Road
	L1S6	1198	365	Structure Controlled	East of Manele Road
	L2S1	377	115	Basal Mode Water (11)	West of Manele Bay Hotel
	L2S2	475	145	Basal Mode Water (10)	West of Manele Bay Hotel
	L2S3	574	175	Ground Water Barrier*	West of Manele Bay Hotel
	L2S4	836	255	Structure Controlled	West of Manele Bay Hotel
	L2S5	558	170	Basal Mode Water (20)	West of Manele Bay Hotel
	MBWELL-1	196	60	Basal Mode Water (2)	At Manele Well 1
	L3S1	492	150	Ground Water Barrier*	North of Manele Bay Hotel
	L3S2	810	247	Structure Controlled	North of Manele Bay Hotel

*Sounding results may be distorted by 2-dimensional geoelectric structures and geoelectric parameters may be in error.

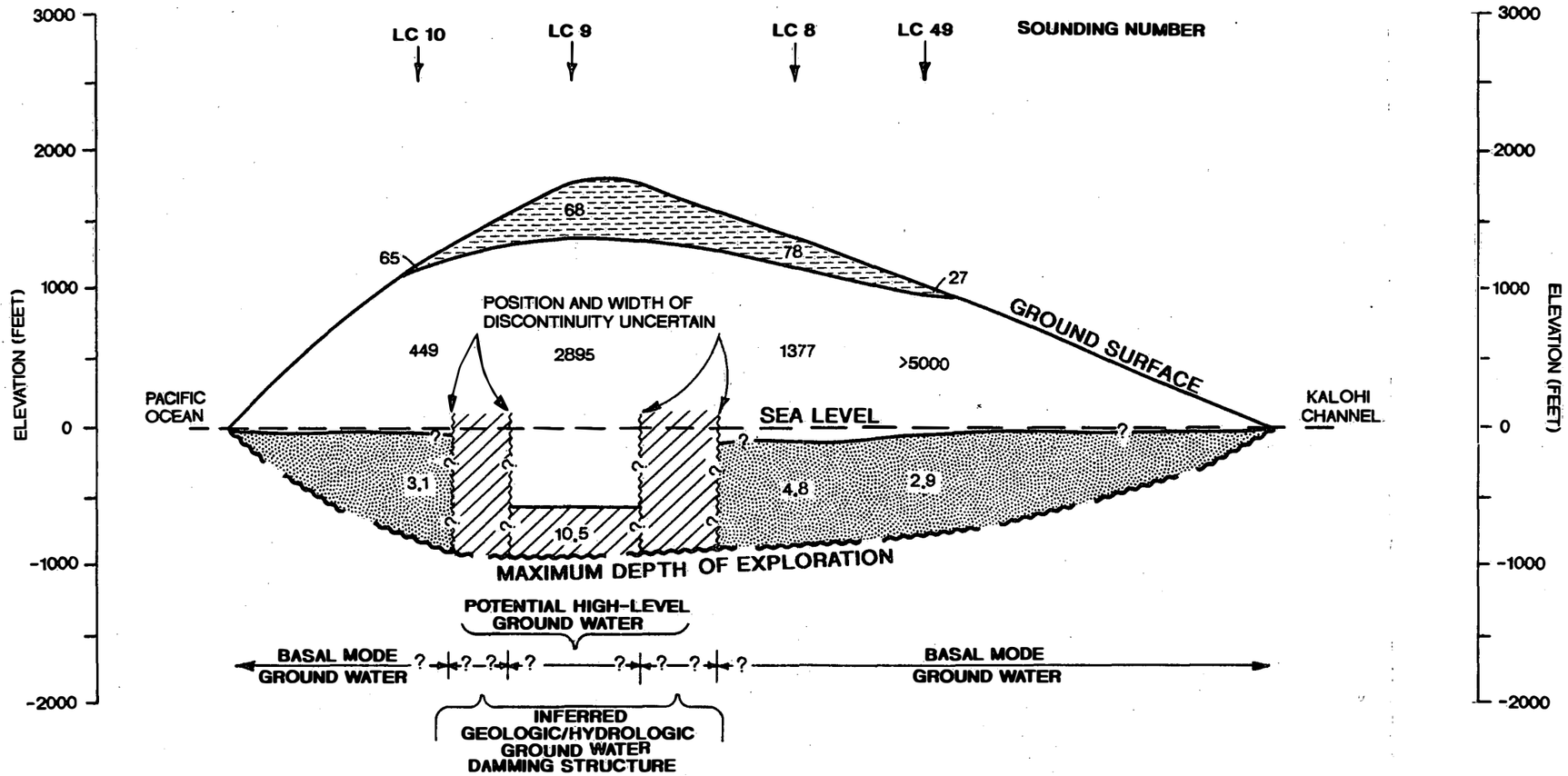


CEES BLACKHAWK GEOSCIENCES DIVISION

CHARACTERISTIC RESISTIVITY RANGES

LANAI WATER COMPANY, INC.
ISLAND OF LANAI, HAWAII

PROJECT NO. 9081-000 FIGURE 5-1



LEGEND

33 Resistivity in ohm-m

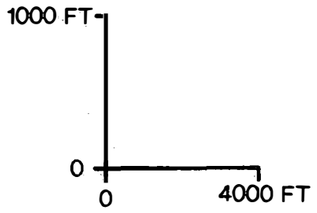
Laterite Soil

Dry Unweathered or Fresh-Brackish Water Saturated Volcanics

Inferred Structure (Possible Ash Flows, Weathered Volcanics or Intrusives)

Salt Water Saturated Volcanics

Inferred Geologic/Hydrologic Discontinuity



CEES BLACKHAWK GEOSCIENCES DIVISION

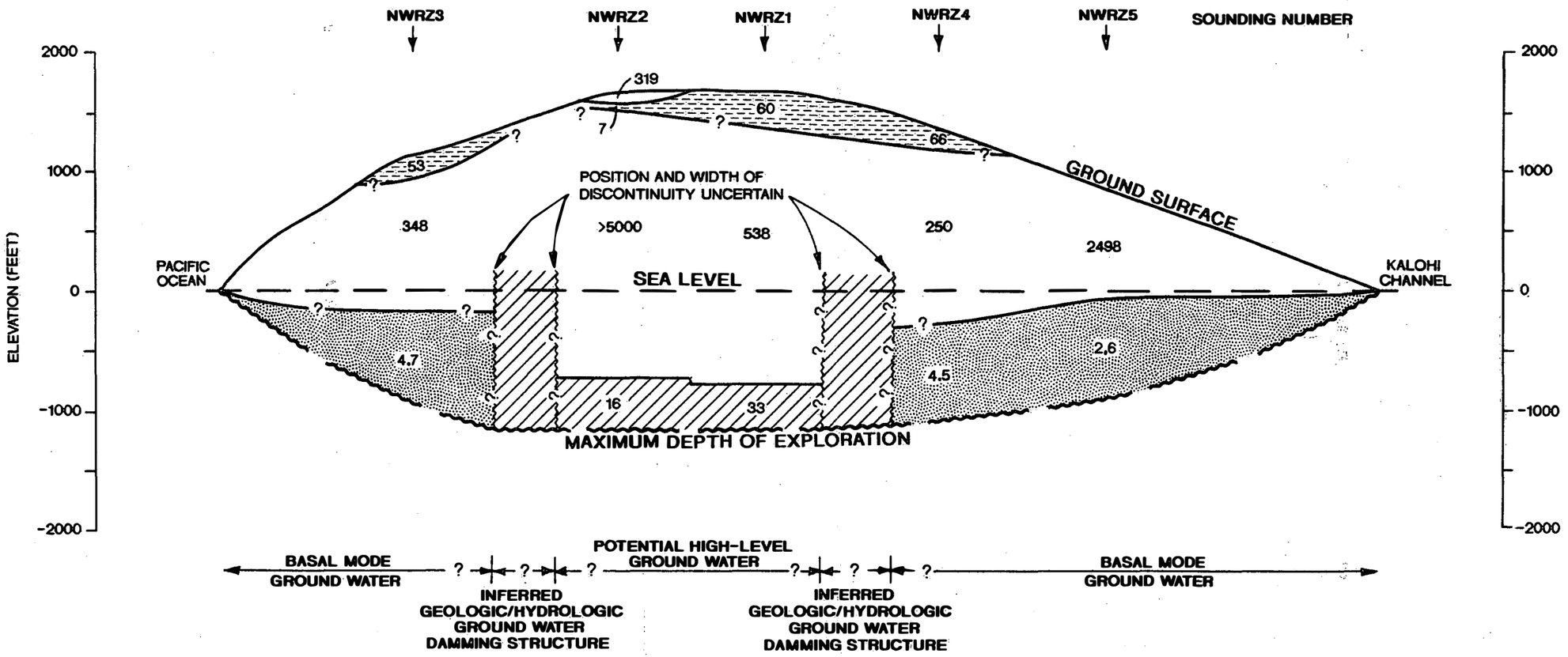
GEOELECTRIC CROSS SECTION A-A'

LANAI WATER COMPANY, INC.
ISLAND OF LANAI, HAWAII

PROJECT NO. 9081-000 FIGURE 5-2

B
SOUTHWEST

B'
NORTHEAST



LEGEND

33 Resistivity in ohm-m

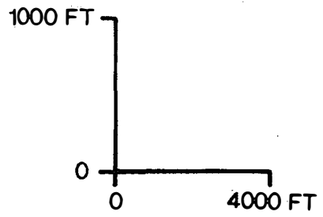
Laterite Soil

Dry Unweathered or Fresh-Brackish Water Saturated Volcanics

Inferred Structure (Possible Ash Flows, Weathered Volcanics or Intrusives)

Salt Water Saturated Volcanics

Inferred Geologic/Hydrologic Discontinuity



CEES BLACKHAWK GEOSCIENCES DIVISION

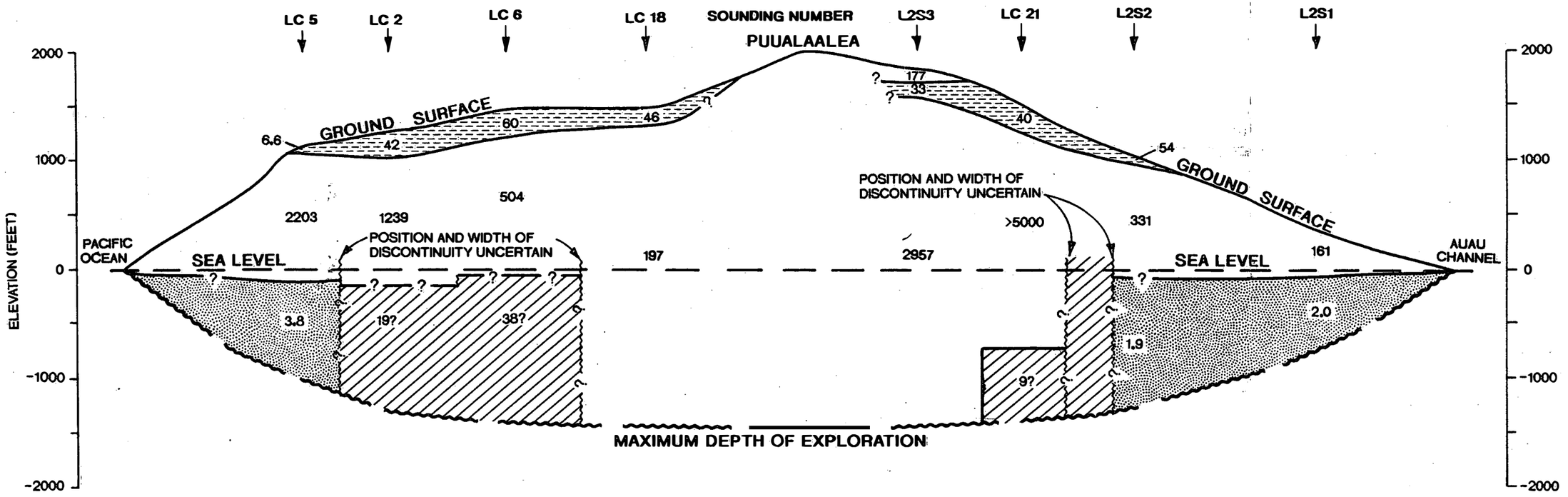
GEOELECTRIC CROSS SECTION B-B'

LANAI WATER COMPANY, INC.
ISLAND OF LANAI, HAWAII

PROJECT NO. 9081-000 FIGURE 5-3

C
SOUTHWEST

C'
NORTHEAST



LEGEND

33 Resistivity in ohm-m

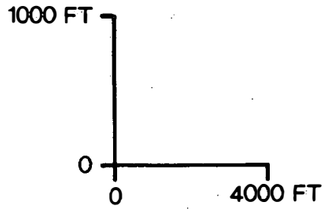
Laterite Soil

Dry Unweathered or Fresh-Brackish Water Saturated Volcanics

Inferred Structure (Possible Ash Flows, Weathered Volcanics or Intrusives)

Salt Water Saturated Volcanics

Inferred Geologic/Hydrologic Discontinuity



CEES BLACKHAWK GEOSCIENCES DIVISION

GEOELECTRIC CROSS SECTION C-C'

LANAI WATER COMPANY, INC.
ISLAND OF LANAI, HAWAII

PROJECT NO. 9081-000 FIGURE 5-4

D
WEST

D'
EAST

ANAPUKA
LC 1
LC 45
LC 44
WELL 6
MAUNALAI GULCH
LC 35
LC 33
LC 34
KAIKENA
HAUOLA GULCH

3000
2000
1000
0
-1000
-2000

ELEVATION (FEET)

GROUND SURFACE
56
51
41
?
HEAD = 1000'
14
915
>5000
4670
GROUND SURFACE
263
1414
POSITION AND WIDTH OF DISCONTINUITY UNCERTAIN
2077
POSITION AND WIDTH OF DISCONTINUITY UNCERTAIN
>5000
PACIFIC OCEAN
SEA LEVEL
TD ?
SEA LEVEL
AUAU CHANNEL
3.5
18?
32
262?
1.6
MAXIMUM DEPTH OF EXPLORATION

BASAL MODE GROUND WATER
INFERRED GEOLOGIC/HYDROLOGIC GROUND WATER DAMMING STRUCTURE
POTENTIAL HIGH-LEVEL GROUND WATER
INFERRED GEOLOGIC/HYDROLOGIC GROUND WATER DAMMING STRUCTURE
BASAL MODE GROUND WATER

LEGEND

- 33 — Resistivity in ohm-m
- Laterite Soil
- Dry Unweathered or Fresh-Brackish Water Saturated Volcanics
- Inferred Structure (Possible Ash Flows, Weathered Volcanics or Intrusives)
- Salt Water Saturated Volcanics
- Inferred Geologic/Hydrologic Discontinuity

1000 FT
0
0
4000 FT

CES BLACKHAWK GEOSCIENCES DIVISION

GEOELECTRIC CROSS SECTION D-D'

LANAI WATER COMPANY, INC.
ISLAND OF LANAI, HAWAII

PROJECT NO. 9081-000 FIGURE 5-5

E
WEST

E'
EAST

PB 11 PB 4 PB 12 PB 8 SOUNDING NUMBER LC 48 LC 37 L1S4 L1S3 L1S2 L1S1

LANAI HALE

WELL 4
(ELEV. 2297'
OFFSET 1400'N)

WELL 2
(ELEV. 1903'
OFFSET 2100' N)

WELL 1
(ELEV. 1247'
OFFS T 2400' S)

WELL 9
(ELEV. 1404'
OFFSET 1800'N)

3000
2000
1000
-1000
-2000

ELEVATION (FEET)

GROUND SURFACE

93 49 37 23 54

101
HEAD=1400'

HEAD=1500'

H AD=812'

H AD=818'

BOTTOM @962

BOTTOM @1147

316

218

531
POSITION AND WIDTH OF
DISCONTINUITY UNCERTAIN

POSITION AND WIDTH OF
DISCONTINUITY UNC RTAIN

147 991 >5000 1354 672 324 168

OCEAN 0

SEA LEVEL

TD ? TD -3' TD ? TD ? SEA LEVEL

2,3 3,4 11 ? 23 36 25 ? 2,4 2,6 1,9

MAXIMUM DEPTH OF EXPLORATION

BASAL MODE
GROUND WATER

INFERRED
GEOLOGIC/HYDROLOGIC
GROUND WATER
DAMMING STRUCTURE

POTENTIAL HIGH-LEVEL GROUND WATER

INFERRED
GEOLOGIC/HYDROLOGIC
GROUND WATER
DAMMING STRUCTURE

BASAL MODE
GROUND WATER

LEGEND

33 Resistivity in ohm-m

Laterite Soil

Dry Unweathered or Fresh-Brackish Water Saturated Volcanics

Inferred Structure (Possible Ash Flows, Weathered Volcanics or Intrusives)

Salt Water Saturated Volcanics

Inferred Geologic/Hydrologic Discontinuity

1000 FT
0
0 4000 FT

CEES BLACKHAWK GEOSCIENCES DIVISION

GEOELECTRIC CROSS SECTION E-E'

LANAI WATER COMPANY, INC.
ISLAND OF LANAI, HAWAII

PROJECT NO. 9081-000 FIGURE 5-6

F
WEST

F'
EAST

PB 17 PB 3 PB 2 PB 7 PB 6 SOUNDING NUMBER LC 43 LC 27 LC 24 LC 25 LC 26

LANAI HALE

WELL 5
(ELEV. 2283'
OFFSET 2900' N)

WELL 1
(ELEV. 1247'
OFFSET 3200' N)

HEAD=1510'

HEAD=818'

TD ?

TD -3'

GROUND SURFACE

SEA LEVEL

OCEAN

POSITION AND WIDTH OF DISCONTINUITY UNCERTAIN

MAXIMUM DEPTH OF EXPLORATION

ELEVATION (FEET)

3000 2000 1000 0 -1000 -2000

30 37 48 32 154 3,3 76 25 441 684 198 234 1009 >5000 720 1467 >5000 2,5 4.5? 25 23 14 79 20? 1,3 2,1

BASAL MODE GROUND WATER — ? — INFERRED GEOLOGIC/HYDROLOGIC GROUND WATER DAMMING STRUCTURE — ? — POTENTIAL HIGH-LEVEL GROUND WATER — ? — INFERRED GEOLOGIC/HYDROLOGIC GROUND WATER DAMMING STRUCTURE — ? — BASAL MODE GROUND WATER

LEGEND

33 Resistivity in ohm-m

Laterite Soil

Dry Unweathered or Fresh-Brackish Water Saturated Volcanics

Inferred Structure (Possible Ash Flows, Weathered Volcanics or Intrusives)

Salt Water Saturated Volcanics

Inferred Geologic/Hydrologic Discontinuity

1000 FT
0
0 4000 FT

CEES BLACKHAWK GEOSCIENCES DIVISION

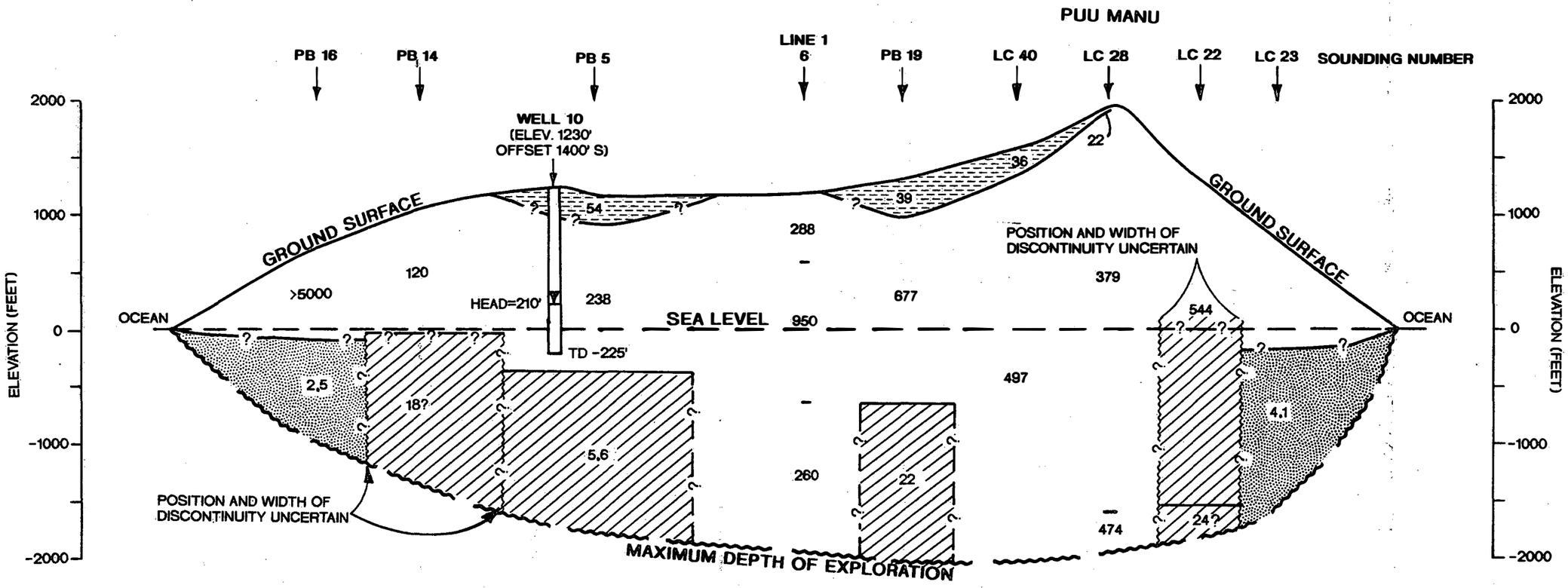
GEOELECTRIC CROSS SECTION F-F'

LANAI WATER COMPANY, INC.
ISLAND OF LANAI, HAWAII

PROJECT NO. 9081-000 FIGURE 5-7

G
WEST

G'
EAST



BASAL MODE GROUND WATER — IN ERRED GEOLOGIC/HYDROLOGIC GROUND WATER DAMMING STRUCTURE — POTENTIAL HIGH-LEVEL GROUND WATER — INFERRED GEOLOGIC/HYDROLOGIC GROUND WATER DAMMING STRUCTURE — BASAL MODE GROUND WATER

LEGEND

33 Resistivity in ohm-m

Laterite Soil

Dry Unweathered or Fresh-Brackish Water Saturated Volcanics

Inferred Structure (Possible Ash Flows, Weathered Volcanics or Intrusives)

Salt Water Saturated Volcanics

Inferred Geologic/Hydrologic Discontinuity

1000 FT
0
0
4000 FT

CEES BLACKHAWK GEOSCIENCES DIVISION

GEOELECTRIC CROSS SECTION G-G'

LANAI WATER COMPANY, INC.
ISLAND OF LANAI, HAWAII

PROJECT NO. 9081-000 FIGURE 5-8

H
SOUTH

H'
NORTH

(LINE 1 1993 DATA)

1 2 3 4 5 6 PB 20 PB 6 SOUNDING NUMBER LC 44 LC 14 LC 15 LC 16

3000 2000 1000 0 -1000 -2000

ELEVATION (FEET)

MANELE WELL (ELEV. 164') HEAD=1.1' TD SEA LEVEL

WELL 1 (ELEV. 1247' OFFSET 2000' E)

WELL 9 (ELEV. 1404')

WELL 7 (ELEV. 1755' OFFSET 800' E)

GROUND SURFACE

OCEAN

SEA LEVEL

HEAD=818'

HEAD=812'

HEAD=680'

TD -3

TD ?

TD ?

BOTTOM @ +280

57 33 84 288 767 172 165 679 519 950 216 56 154 3.4 1009 51 2077 54 50 180 493 16 2009 4513 2442

1.7 1.8 2.9 8.9? 30? 260 11.2 19.3 32 2.1

POSITION AND WIDTH OF DICONTINUITY UNCERTAIN

MAXIMUM DEPTH OF EXPLORATION

POSITION AND WIDTH OF DICONTINUITY UNCERTAIN

BASAL MODE GROUND WATER

INFERRED GEOLOGIC/HYDROLOGIC GROUND WATER DAMMING STRUCTURE

POTENTIAL HIGH-LEVEL GROUND WATER

INFERRED GEOLOGIC/HYDROLOGIC GROUND WATER DAMMING STRUCTURE

BASAL MODE GROUND WATER

LEGEND

33 Resistivity in ohm-m

Laterite Soil

Dry Unweathered or Fresh-Brackish Water Saturated Volcanics

Inferred Structure (Possible Ash Flows, Weathered Volcanics or Intrusives)

Salt Water Saturated Volcanics

Inferred Geologic/Hydrologic Discontinuity

1000 FT
0
0 4000 FT

CEES BLACKHAWK GEOSCIENCES DIVISION

GEOELECTRIC CROSS SECTION H-H'

LANAI WATER COMPANY, INC.
ISLAND OF LANAI, HAWAII

PROJECT NO. 9081-000 FIGURE 5-9

Map

Goes

Here

6.0 Conclusions and Recommendations

General

The main objective of the TDEM surveys was to assist in the basal and high-level ground water resource evaluation at selected sites during different phases of work throughout the island. The interpretations derived from the individual TDEM soundings are incorporated into one data set and are shown in Figure 5-10. Three distinct areas of hydrogeologic behavior are observed in the summary map:

1. Areas where ground water is expected in the basal mode. The salt water interface is detected in these soundings and the thickness of the fresh/brackish water lens can be calculated from the interpreted interface from each sounding. The accuracy in determining the depth to the salt water saturated interface is estimated to be ± 5% of the total depth measured.

2. Areas where resistivity values are expected to be influenced by lateral discontinuities and where ground water flow is controlled by geologic/hydrologic barriers (e.g., dikes). Ground water levels, water quality and production within these areas are expected to be highly variable.

3. Areas of structurally controlled ground water (potential high-level water). The interpreted boundary between the geologic/hydrologic discontinuity and structure controlled ground water occurs at different elevations throughout the island. In these areas the high-level water could be contained in separate compartments behind the discontinuity. The water production from a single compartment is determined by several important factors which include porosity, permeability, recharge to and size of the compartment.

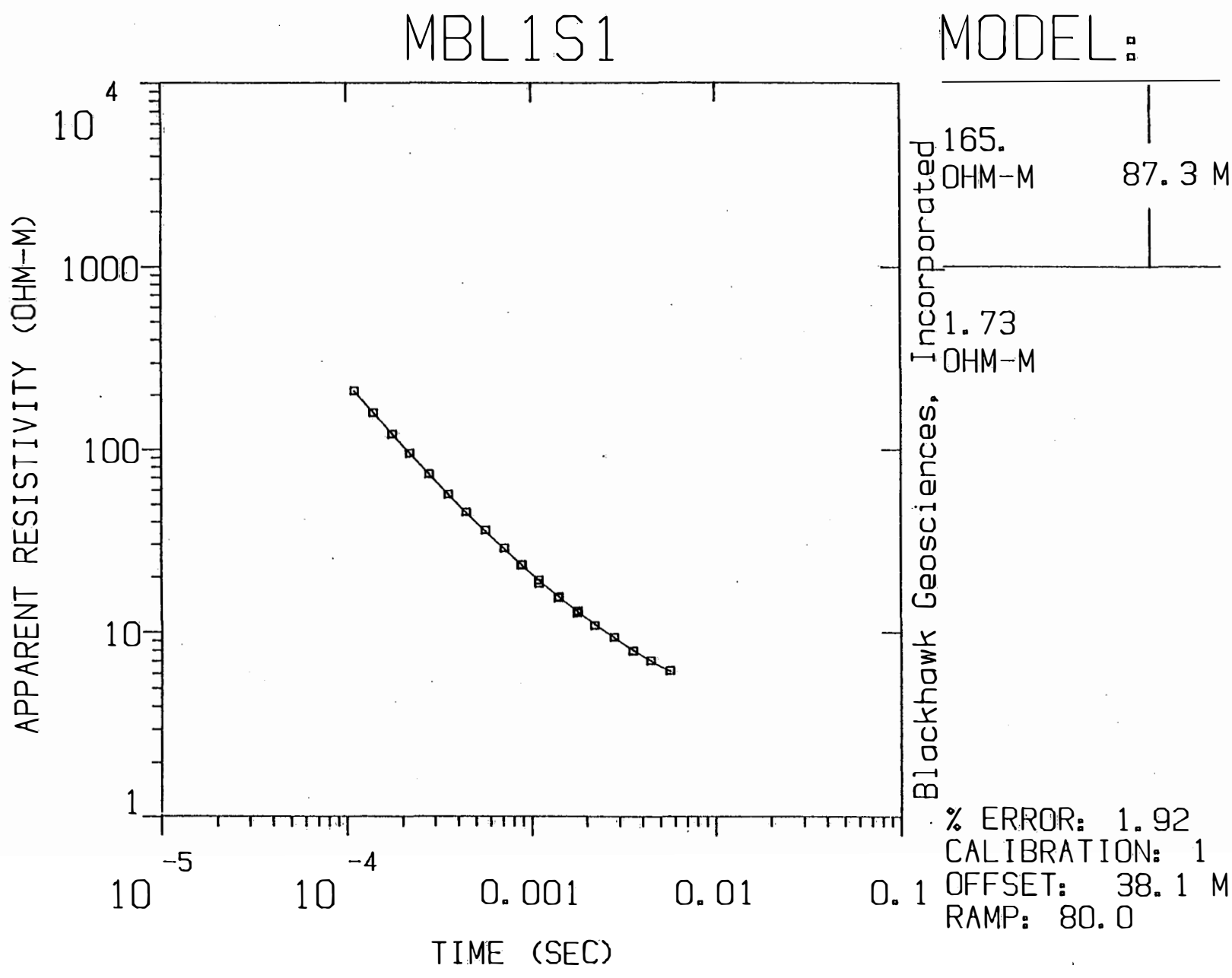
The relative accuracy in determining the exact location of the boundary between the geologic/hydrologic discontinuity by TDEM measurements is influenced by several factors:

1. Lateral discontinuities effecting the 1-dimensional (1-D) interpretations of the TDEM sounding data. The apparent geologic structures causing the damming of the ground water flow may be considerably narrower than the wide geologic/hydrologic discontinuity indicated on Figure 5-10. TDEM measurements are effected by lateral changes in the subsurface, and the exact location of these features cannot be determined.

2. Horizontal distances between TDEM measurements (data density) across the discontinuity are in some cases relatively large (greater than 5,000 ft). During the course of the survey, fill-in soundings were placed in areas to help delineate the (inland) hydrogeologic boundary more accurately. Discussions were held with the LWCI consulting hydrogeologist and it was determined that sufficient data coverage had been made to determine the inland boundary.

The results from the geophysical surveys (ref. Fig. 5-10) illustrate the utility of TDEM soundings in mapping the hydrogeologic boundary between the basal mode water and potential high-level ground water. The comprehensive geophysical evaluation indicates that of the 140 square mile area of the Island of Lanai, the potential for high-level ground water exists in approximately thirty-six square miles in the central portion of the island. Basal mode ground water is expected throughout the outer portions of the island and it is estimated to be contained in approximately seventy square miles of the island. The basal mode water resource is, however, expected to be highly variable in these portions of the island, and the fresh/brackish water lens calculated from the TDEM data is expected to be of limited quantity.

This is the most comprehensive geophysical study about the potential water resources of an entire island. The information provided by the TDEM survey will prove cost effective in future well placement and hydrogeologic modeling of the potential water resources of the Island of Lanai.


MBL1S1
MODEL:
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
165.
OHM-M
87.3 M
1.73
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 1.92
CALIBRATION: 1
OFFSET: 38.1 M
RAMP: 80.0

MBL1S1

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	(FEET)	CONDUCTANCE (S) LAYER	TOTAL
		75.0	246.0		
165.43	87.3	-12.4	-40.5	0.5	0.5
1.73					

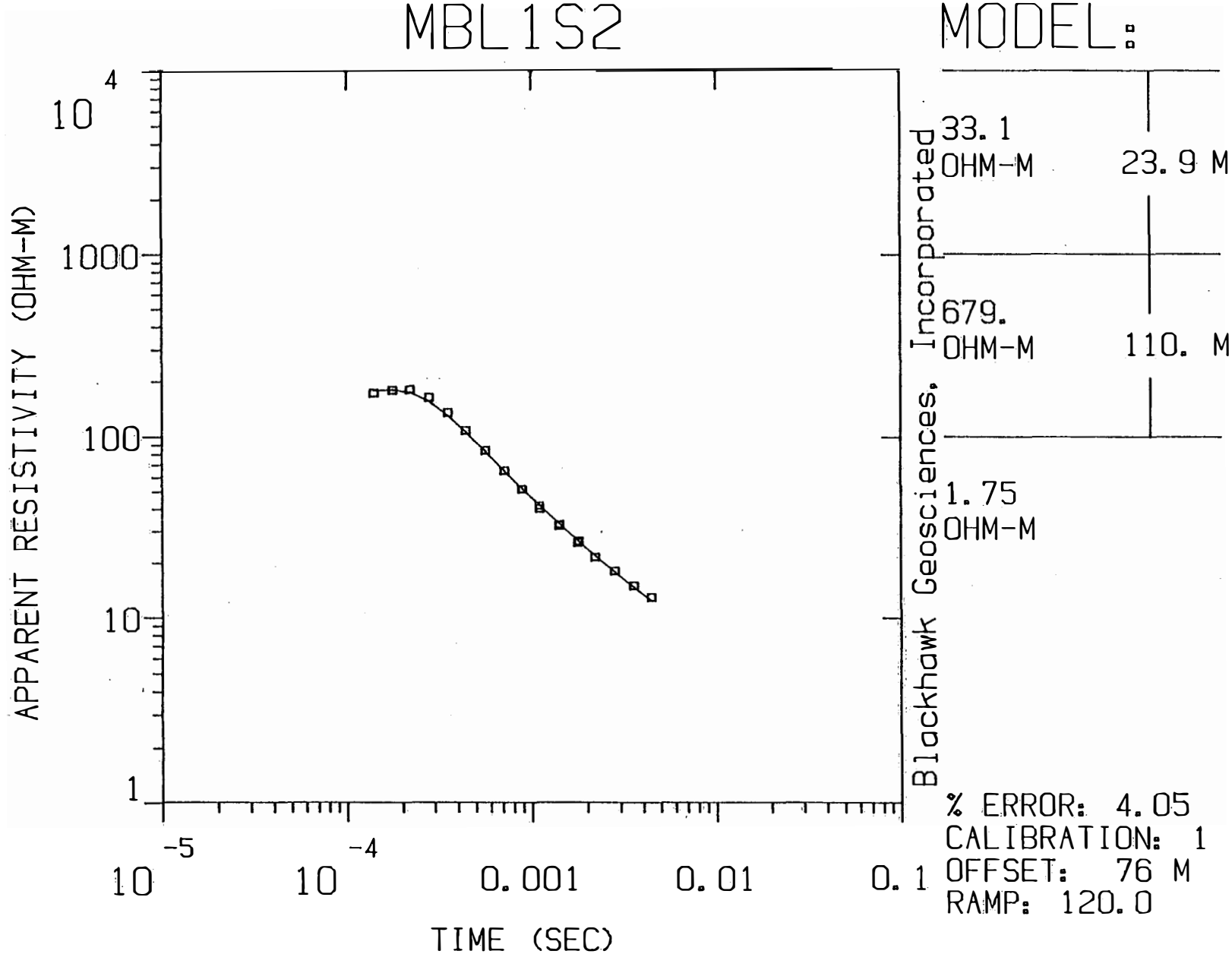
	TIMES	DATA	CALC	% ERROR	STD ERR
1	1.10E-04	2.10E+02	2.10E+02	-0.237	
2	1.40E-04	1.59E+02	1.59E+02	0.033	
3	1.77E-04	1.21E+02	1.21E+02	-0.221	
4	2.20E-04	9.48E+01	9.48E+01	-0.014	
5	2.80E-04	7.28E+01	7.26E+01	0.202	
6	3.55E-04	5.65E+01	5.63E+01	0.230	
7	4.43E-04	4.50E+01	4.48E+01	0.622	
8	5.64E-04	3.57E+01	3.51E+01	1.606	
9	7.13E-04	2.84E+01	2.80E+01	1.291	
10	8.81E-04	2.31E+01	2.31E+01	0.063	
11	8.90E-04	2.30E+01	2.29E+01	0.576	
12	1.10E-03	1.91E+01	1.90E+01	0.106	
13	1.10E-03	1.83E+01	1.90E+01	-3.556	
14	1.40E-03	1.53E+01	1.55E+01	-1.657	
15	1.41E-03	1.55E+01	1.54E+01	0.693	
16	1.77E-03	1.26E+01	1.29E+01	-2.024	
17	1.80E-03	1.30E+01	1.28E+01	1.770	
18	2.20E-03	1.08E+01	1.10E+01	-1.472	
19	2.80E-03	9.34E+00	9.27E+00	0.747	
20	3.55E-03	7.88E+00	7.95E+00	-0.846	
21	4.43E-03	7.00E+00	6.96E+00	0.620	
22	5.64E-03	6.18E+00	6.08E+00	1.639	

R: 38. X: 0. Y: 38. DL: 76. REQ: 42. CF: 1.0000
CLHZ ARRAY, 22 DATA POINTS, RAMP: 80.0 MICROSEC, DATA: MBL1S1
0502 100 1NZ OPR L 5 8 -
Ch.21 = 0.08 Ch.22 = 0.89 Ch.23 = 19.5 Ch.24 =
RMS LOG ERROR: 8.25E-03, ANTILOG YIELDS 1.9168 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.23		
P 2	-0.08	0.96	
T 1	0.03	0.00	1.00
	P 1	P 2	T 1


MBL1S2
MODEL:
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
33.1
OHM-M
23.9 M
679.
OHM-M
110. M
1.75
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 4.05
CALIBRATION: 1
OFFSET: 76 M
RAMP: 120.0

MBL1S2

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		120.1	394.0		
33.08	23.9	96.2	315.5	0.7	0.7
678.91	110.2	-14.0	-46.0	0.2	0.9
1.75					

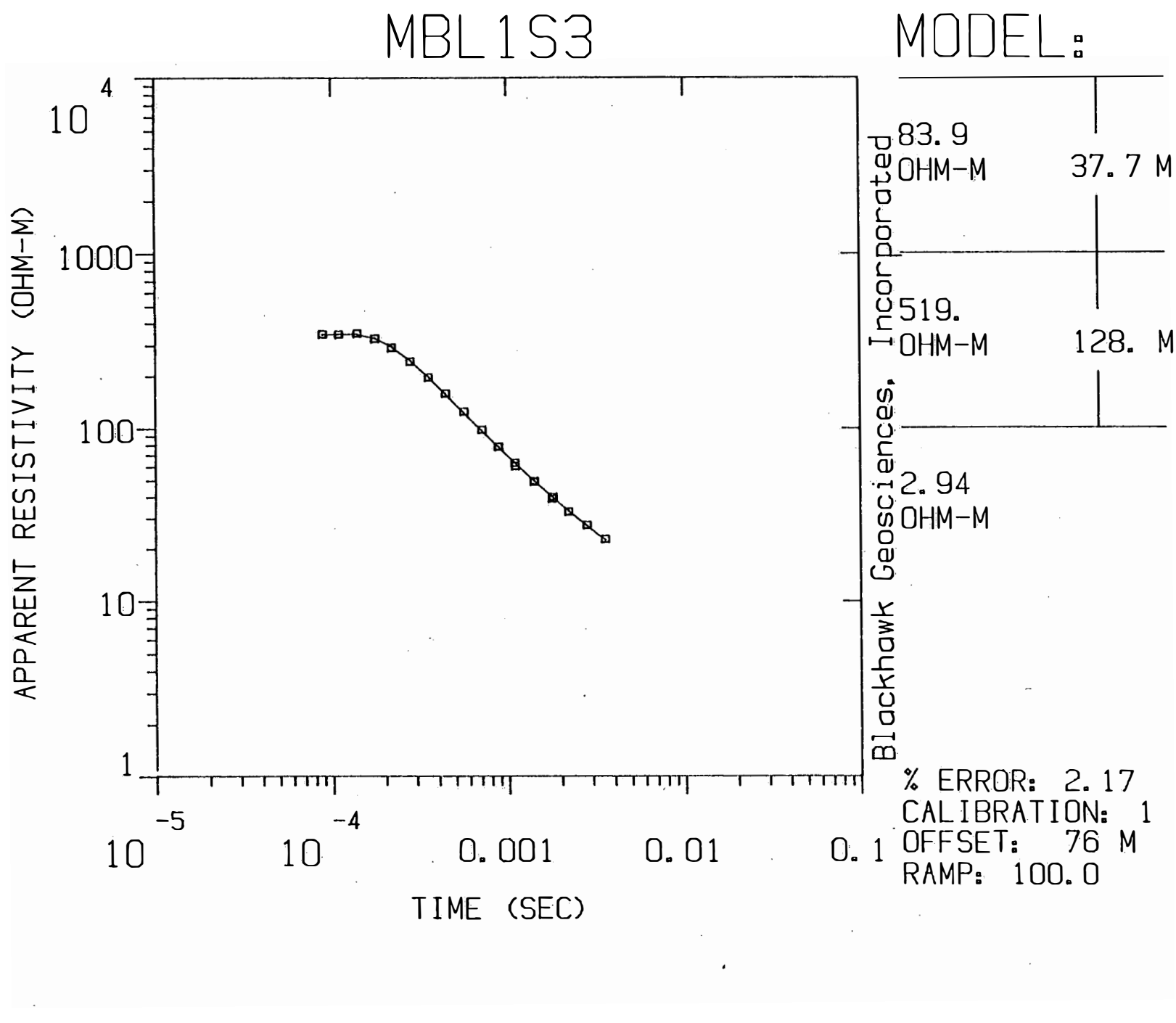
	TIMES	DATA	CALC	% ERROR	STD ERR
1	1.40E-04	1.73E+02	1.80E+02	-3.917	
2	1.77E-04	1.79E+02	1.81E+02	-1.087	
3	2.20E-04	1.81E+02	1.75E+02	3.366	
4	2.80E-04	1.64E+02	1.57E+02	4.697	
5	3.55E-04	1.36E+02	1.31E+02	3.761	
6	4.43E-04	1.08E+02	1.06E+02	1.586	
7	5.64E-04	8.41E+01	8.33E+01	0.970	
8	7.13E-04	6.53E+01	6.53E+01	-0.037	
9	8.81E-04	5.18E+01	5.26E+01	-1.359	
10	8.90E-04	5.18E+01	5.20E+01	-0.419	
11	1.10E-03	4.16E+01	4.22E+01	-1.396	
12	1.10E-03	4.02E+01	4.20E+01	-4.457	
13	1.40E-03	3.22E+01	3.32E+01	-3.245	
14	1.41E-03	3.28E+01	3.30E+01	-0.615	
15	1.77E-03	2.59E+01	2.67E+01	-3.037	
16	1.80E-03	2.65E+01	2.63E+01	0.511	
17	2.20E-03	2.15E+01	2.19E+01	-1.804	
18	2.80E-03	1.80E+01	1.78E+01	1.230	
19	3.55E-03	1.49E+01	1.47E+01	1.903	
20	4.43E-03	1.29E+01	1.24E+01	4.554	

R: 76. X: 0. Y: 76. DL: 152. REQ: 84. CF: 1.0000
CLHZ ARRAY, 20 DATA POINTS, RAMP: 120.0 MICROSEC, DATA: MBL1S2
0502 100 2NZ OPR L 5 8 -
Ch.21 = 0.12 Ch.22 = 0.89 Ch.23 = 19 Ch.24 = 23
RMS LOG ERROR: 1.73E-02, ANTILOG YIELDS 4.0524 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.52				
P 2	0.03	0.00			
P 3	-0.03	-0.01	0.18		
T 1	-0.43	-0.03	0.06	0.41	
T 2	0.10	0.01	0.00	0.11	0.95
	P 1	P 2	P 3	T 1	T 2


MBL1S3
MODEL:
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
Blackhawk Geosciences, Incorporated
83.9
OHM-M
37.7 M
519.
OHM-M
128. M
2.94
OHM-M
% ERROR: 2.17
CALIBRATION: 1
OFFSET: 76 M
RAMP: 100.0

MBL1S3

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	(FEET)	CONDUCTANCE (S) LAYER	TOTAL
		154.8	508.0		
83.87	37.7	117.2	384.4	0.4	0.4
518.60	128.1	-10.9	-35.8	0.2	0.7
2.94					

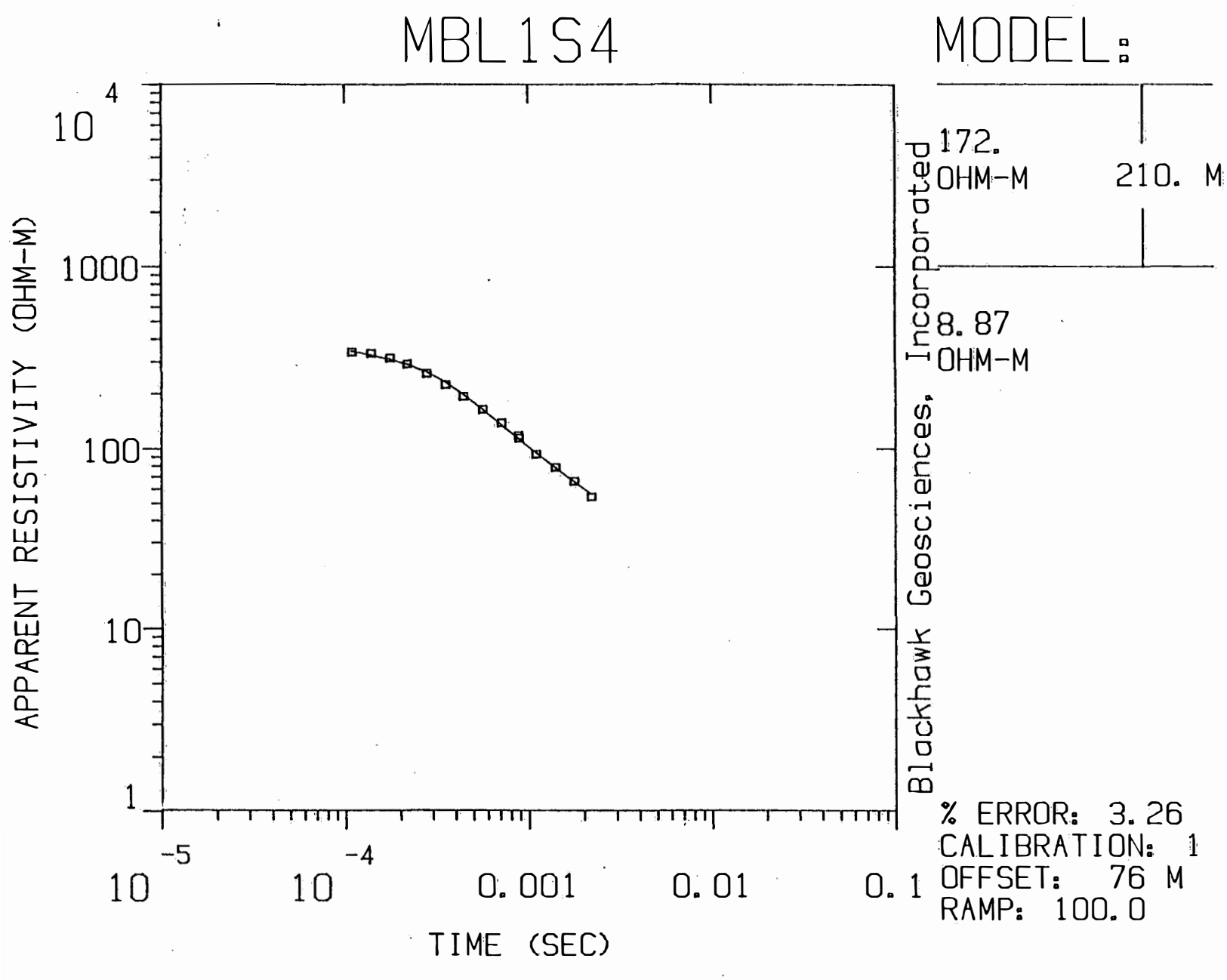
	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	3.46E+02	3.46E+02	0.101	
2	1.10E-04	3.45E+02	3.48E+02	-0.767	
3	1.40E-04	3.50E+02	3.46E+02	1.312	
4	1.77E-04	3.27E+02	3.28E+02	-0.313	
5	2.20E-04	2.91E+02	2.95E+02	-1.261	
6	2.80E-04	2.42E+02	2.46E+02	-1.460	
7	3.55E-04	1.96E+02	1.97E+02	-0.381	
8	4.43E-04	1.59E+02	1.57E+02	0.891	
9	5.64E-04	1.25E+02	1.22E+02	2.067	
10	7.13E-04	9.77E+01	9.61E+01	1.679	
11	8.81E-04	7.78E+01	7.76E+01	0.295	
12	8.90E-04	7.78E+01	7.68E+01	1.299	
13	1.10E-03	6.27E+01	6.26E+01	0.188	
14	1.10E-03	6.01E+01	6.23E+01	-3.560	
15	1.40E-03	4.89E+01	4.95E+01	-1.309	
16	1.41E-03	4.94E+01	4.92E+01	0.476	
17	1.77E-03	3.89E+01	4.00E+01	-2.642	
18	1.80E-03	4.00E+01	3.95E+01	1.299	
19	2.20E-03	3.27E+01	3.30E+01	-1.067	
20	2.80E-03	2.73E+01	2.70E+01	0.988	
21	3.55E-03	2.26E+01	2.24E+01	1.122	

R: 76. X: 0. Y: 76. DL: 152. REQ: 84. CF: 1.0000
CLHZ ARRAY, 21 DATA POINTS, RAMP: 100.0 MICROSEC, DATA: MBL1S3
0602 100N 3NZ OPR L 5 8 -TXP=3 1
Ch.21 = 0.1 Ch.22 = 0.89 Ch.23 = 15.5 Ch.24 = 2
RMS LOG ERROR: 9.34E-03, ANTILOG YIELDS 2.1734 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.78				
P 2	0.04	0.05			
P 3	0.04	-0.04	0.90		
T 1	-0.29	-0.15	0.07	0.57	
T 2	0.08	0.05	-0.02	0.12	0.97
	P 1	P 2	P 3	T 1	T 2


MBL1S4
MODEL:
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
172.
OHM-M
210. M
8.87
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 3.26
CALIBRATION: 1
OFFSET: 76 M
RAMP: 100.0

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		219.5	720.0		
171.55	210.3	9.1	29.9	1.2	1.2
8.87					

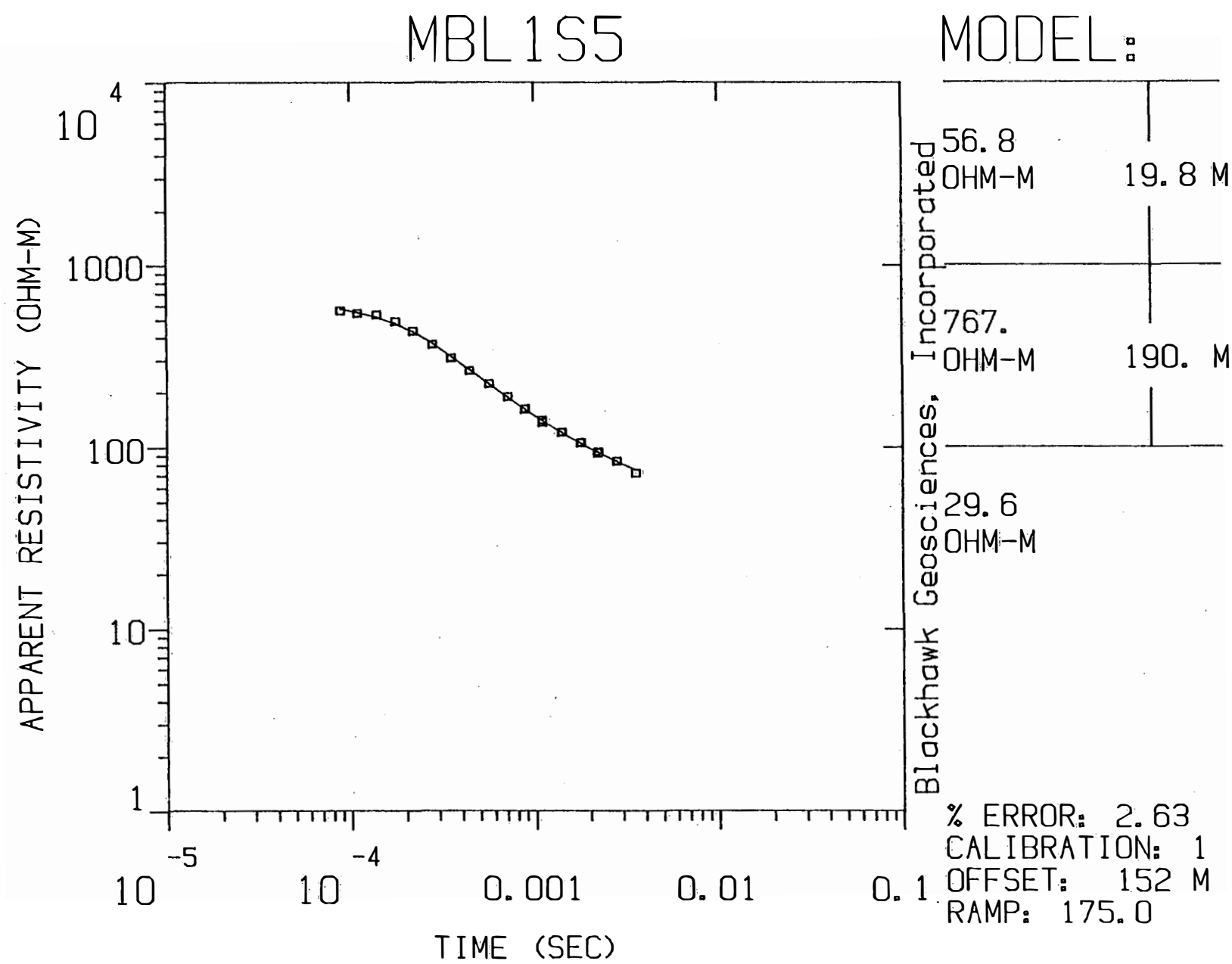
	TIMES	DATA	CALC	% ERROR	STD ERR
1	1.10E-04	3.37E+02	3.43E+02	-1.533	
2	1.40E-04	3.32E+02	3.24E+02	2.413	
3	1.77E-04	3.13E+02	3.08E+02	1.754	
4	2.20E-04	2.91E+02	2.90E+02	0.374	
5	2.80E-04	2.57E+02	2.63E+02	-2.211	
6	3.55E-04	2.23E+02	2.30E+02	-2.918	
7	4.43E-04	1.92E+02	1.97E+02	-2.320	
8	5.64E-04	1.63E+02	1.63E+02	-0.021	
9	7.13E-04	1.38E+02	1.34E+02	2.553	
10	8.81E-04	1.17E+02	1.13E+02	3.892	
11	8.90E-04	1.14E+02	1.12E+02	1.586	
12	1.10E-03	9.26E+01	9.42E+01	-1.612	
13	1.40E-03	7.83E+01	7.79E+01	0.523	
14	1.77E-03	6.57E+01	6.52E+01	0.680	
15	2.20E-03	5.40E+01	5.58E+01	-3.295	

R: 76. X: 0. Y: 76. DL: 152. REQ: 84. CF: 1.0000
CLHZ ARRAY, 15 DATA POINTS, RAMP: 100.0 MICROSEC, DATA: MBL1S4
0602 100N 4NZ OPR L 6 8 -TXP=4
Ch.21 = 0.1 Ch.22 = 0.89 Ch.23 = 15.5 Ch.24 = 2
RMS LOG ERROR: 1.39E-02, ANTILOG YIELDS 3.2579 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	1.00		
P 2	0.00	1.00	
T 1	0.00	0.00	1.00
	P 1	P 2	T 1


MBL1S5
MODEL:
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
56.8
OHM-M
19.8 M
767.
OHM-M
190. M
29.6
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 2.63
CALIBRATION: 1
OFFSET: 152 M
RAMP: 175.0

MBL1S5

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		270.1	886.0		
56.75	19.8	250.2	821.0	0.3	0.3
767.35	190.1	60.1	197.2	0.2	0.6
29.63					

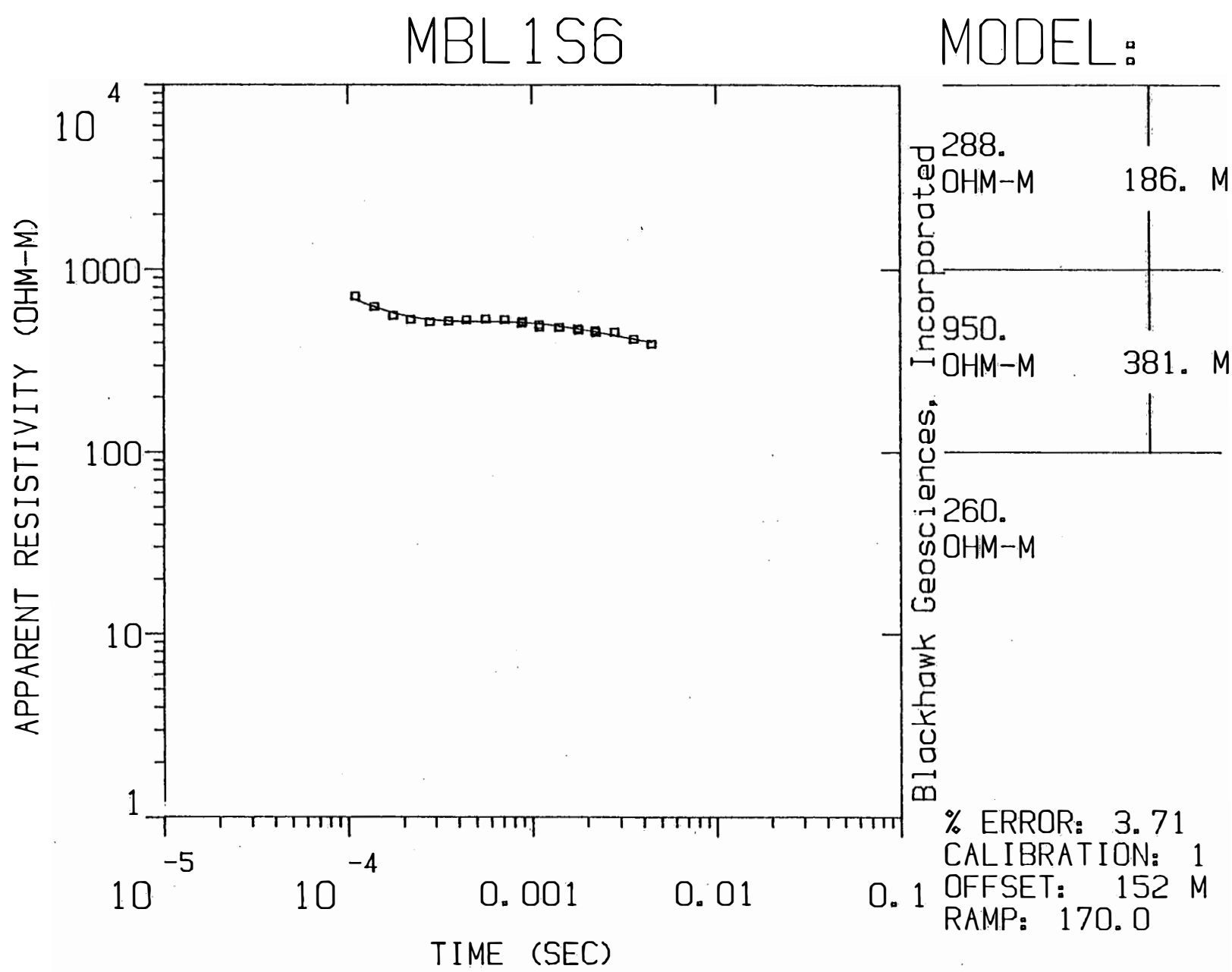
	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	5.66E+02	5.78E+02	-2.127	
2	1.10E-04	5.47E+02	5.51E+02	-0.732	
3	1.40E-04	5.37E+02	5.18E+02	3.591	
4	1.77E-04	4.91E+02	4.78E+02	2.765	
5	2.20E-04	4.35E+02	4.31E+02	0.965	
6	2.80E-04	3.67E+02	3.72E+02	-1.306	
7	3.55E-04	3.09E+02	3.15E+02	-1.914	
8	4.43E-04	2.63E+02	2.67E+02	-1.400	
9	5.64E-04	2.22E+02	2.22E+02	0.091	
10	7.13E-04	1.89E+02	1.87E+02	0.814	
11	8.81E-04	1.61E+02	1.61E+02	-0.025	
12	8.90E-04	1.63E+02	1.60E+02	1.663	
13	1.10E-03	1.40E+02	1.40E+02	0.647	
14	1.10E-03	1.37E+02	1.39E+02	-1.817	
15	1.40E-03	1.20E+02	1.20E+02	0.362	
16	1.41E-03	1.21E+02	1.19E+02	1.248	
17	1.77E-03	1.05E+02	1.05E+02	0.518	
18	1.80E-03	1.06E+02	1.04E+02	1.904	
19	2.20E-03	9.26E+01	9.33E+01	-0.727	
20	2.22E-03	9.43E+01	9.28E+01	1.620	
21	2.80E-03	8.37E+01	8.30E+01	0.903	
22	3.55E-03	7.18E+01	7.47E+01	-3.925	

R: 152. X: 0. Y: 152. DL: 304. REQ: 169. CF: 1.0000
CLHZ ARRAY, 22 DATA POINTS, RAMP: 175.0 MICROSEC, DATA: MBL1S5
0207 100N 5NZ OPR L 6 8 -LIN=100N 2
Ch.21 = 0.175 Ch.22 = 0.89 Ch.23 = 15 Ch.24 = 9
RMS LOG ERROR: 1.13E-02, ANTILOG YIELDS 2.6328 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.66				
P 2	0.02	0.13			
P 3	0.03	-0.04	0.97		
T 1	-0.37	-0.20	0.03	0.53	
T 2	0.03	0.06	0.01	0.05	0.99
	P 1	P 2	P 3	T 1	T 2


MBL1S6
MODEL:
APPARENT RESISTIVITY (OHM-M)
10 4
1000
100
10
1
10 -5
10 -4
0.001
0.01
0.1
TIME (SEC)
Blackhawk Geosciences, Incorporated
288.
OHM-M
186. M
950.
OHM-M
381. M
260.
OHM-M
% ERROR: 3.71
CALIBRATION: 1
OFFSET: 152 M
RAMP: 170.0

MBL1S6

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		365.2	1198.0		
288.15	186.4	178.8	586.6	0.6	0.6
949.63	381.0	-202.2	-663.3	0.4	1.0
259.96					

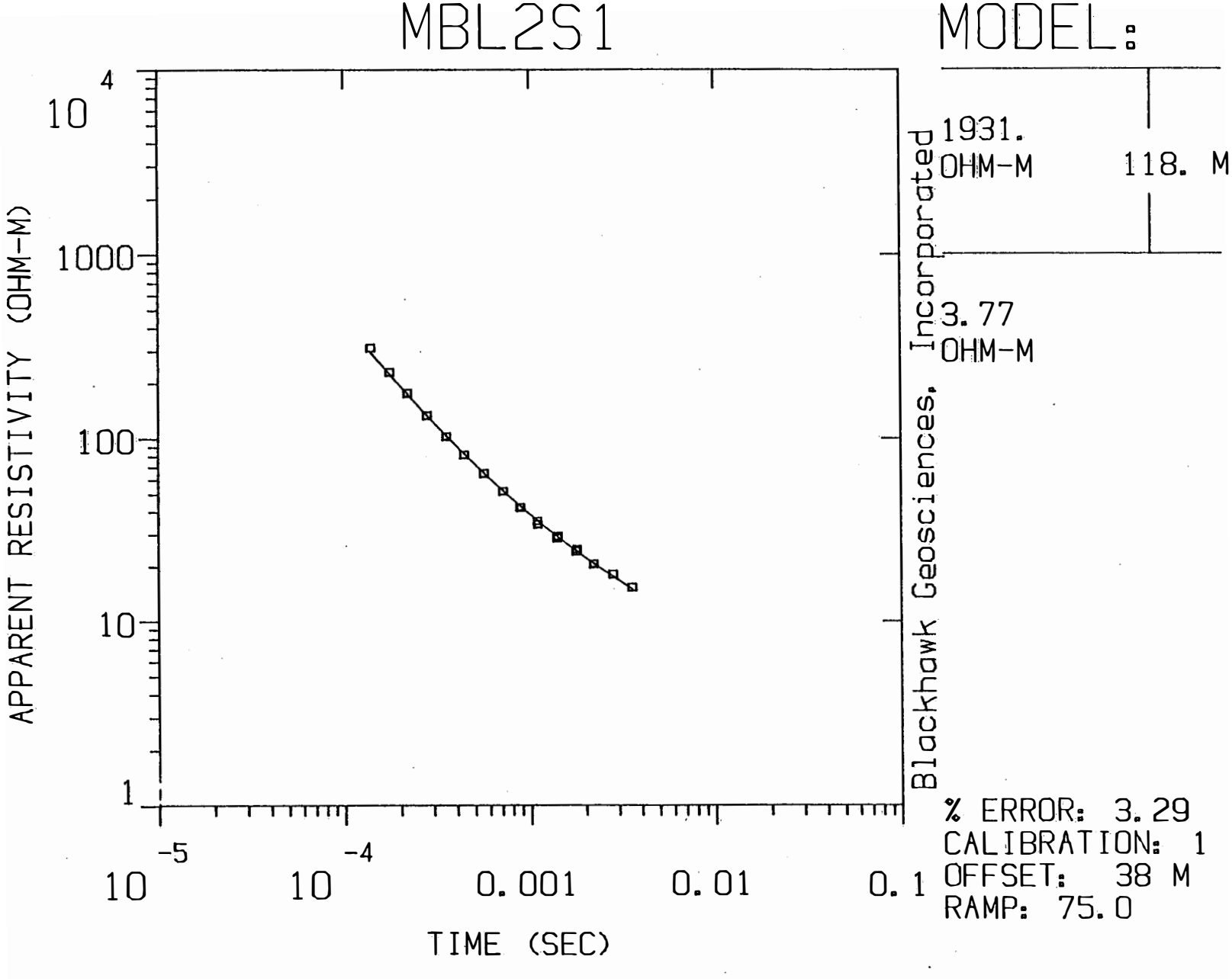
	TIMES	DATA	CALC	% ERROR	STD ERR
1	1.10E-04	7.15E+02	6.85E+02	4.483	
2	1.40E-04	6.27E+02	6.21E+02	0.820	
3	1.77E-04	5.60E+02	5.78E+02	-3.025	
4	2.20E-04	5.34E+02	5.50E+02	-2.950	
5	2.80E-04	5.17E+02	5.31E+02	-2.556	
6	3.55E-04	5.23E+02	5.21E+02	0.430	
7	4.43E-04	5.32E+02	5.18E+02	2.762	
8	5.64E-04	5.37E+02	5.17E+02	3.917	
9	7.13E-04	5.33E+02	5.16E+02	3.373	
10	8.81E-04	5.10E+02	5.12E+02	-0.410	
11	8.90E-04	5.20E+02	5.12E+02	1.647	
12	1.10E-03	4.99E+02	5.04E+02	-1.071	
13	1.10E-03	4.85E+02	5.04E+02	-3.845	
14	1.40E-03	4.84E+02	4.91E+02	-1.372	
15	1.41E-03	4.83E+02	4.90E+02	-1.378	
16	1.77E-03	4.75E+02	4.74E+02	0.305	
17	1.80E-03	4.68E+02	4.73E+02	-0.987	
18	2.20E-03	4.64E+02	4.56E+02	1.616	
19	2.22E-03	4.55E+02	4.55E+02	-0.173	
20	2.80E-03	4.56E+02	4.36E+02	4.524	
21	3.55E-03	4.17E+02	4.17E+02	-0.059	
22	4.43E-03	3.92E+02	4.01E+02	-2.217	

R: 152. X: 0. Y: 152. DL: 304. REQ: 169. CF: 1.0000
CLHZ ARRAY, 22 DATA POINTS, RAMP: 170.0 MICROSEC, DATA: MBL1S6
0207 100N 66NZ OPR L 7 10-
Ch.21 = 0.17 Ch.22 = 0.89 Ch.23 = 15 Ch.24 = 92
RMS LOG ERROR: 1.58E-02, ANTILOG YIELDS 3.7115 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2
P 1	0.98				
P 2	-0.06	0.49			
P 3	0.01	-0.05	0.90		
T 1	-0.07	-0.31	0.02	0.73	
T 2	0.03	0.32	0.09	0.17	0.75


MBL2S1
MODEL:
APPARENT RESISTIVITY (OHM-M)
10 4
1000
100
10
1
10 -5
10 -4
0.001
0.01
0.1
TIME (SEC)
1931.
OHM-M
118. M
3.77
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 3.29
CALIBRATION: 1
OFFSET: 38 M
RAMP: 75.0

MBL2S1

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		114.9	377.0		
1931.42	118.3	-3.4	-11.2	0.1	0.1
3.77					

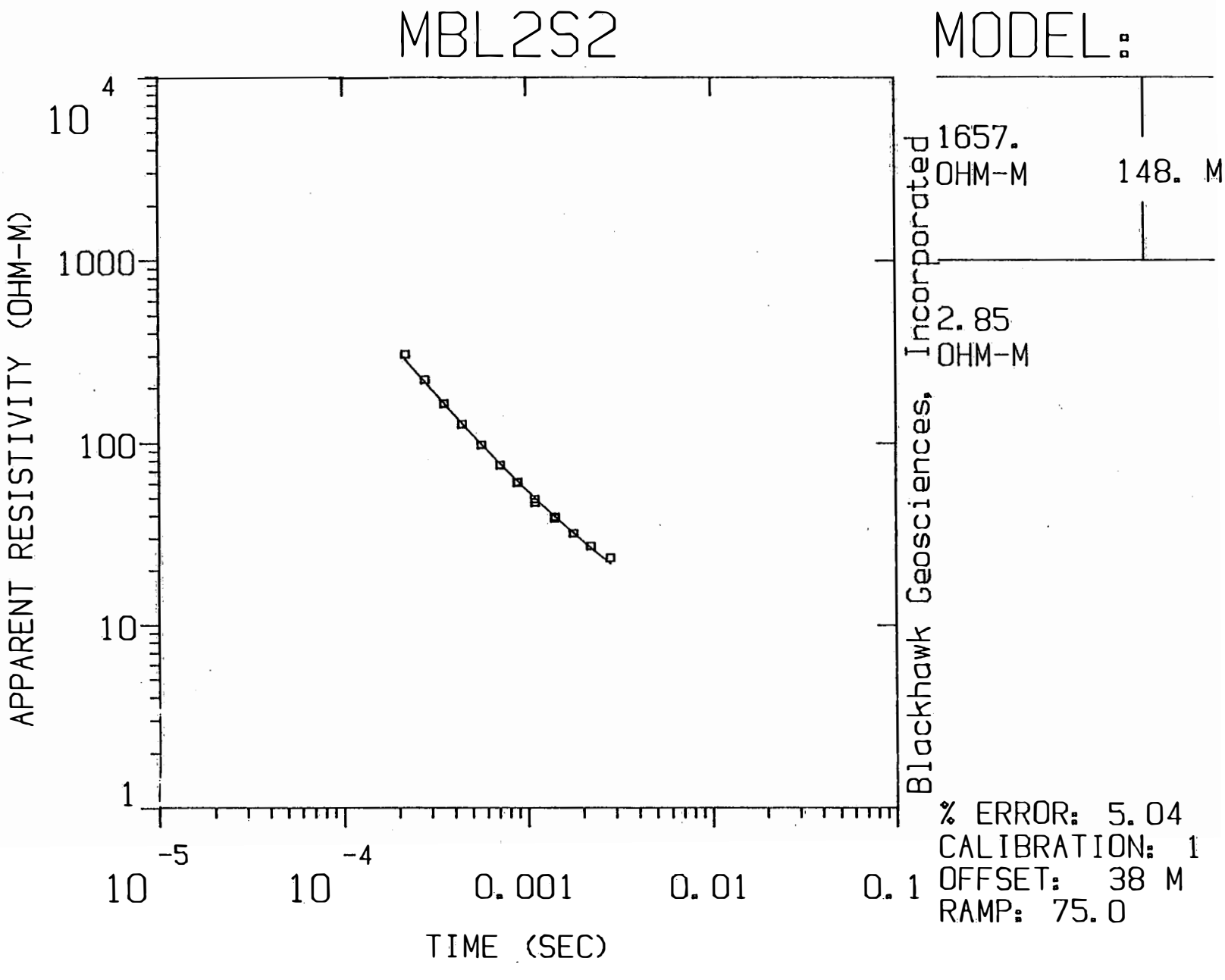
	TIMES	DATA	CALC	% ERROR	STD ERR
1	1.40E-04	3.12E+02	2.96E+02	5.258	
2	1.77E-04	2.30E+02	2.24E+02	2.326	
3	2.20E-04	1.76E+02	1.75E+02	0.759	
4	2.80E-04	1.33E+02	1.34E+02	-0.447	
5	3.55E-04	1.02E+02	1.04E+02	-1.349	
6	4.43E-04	8.13E+01	8.26E+01	-1.609	
7	5.64E-04	6.45E+01	6.49E+01	-0.648	
8	7.13E-04	5.16E+01	5.20E+01	-0.746	
9	8.81E-04	4.22E+01	4.30E+01	-1.879	
10	8.90E-04	4.21E+01	4.27E+01	-1.296	
11	1.10E-03	3.53E+01	3.55E+01	-0.703	
12	1.10E-03	3.39E+01	3.54E+01	-4.202	
13	1.40E-03	2.85E+01	2.92E+01	-2.260	
14	1.41E-03	2.92E+01	2.90E+01	0.696	
15	1.77E-03	2.41E+01	2.43E+01	-0.720	
16	1.80E-03	2.48E+01	2.41E+01	3.047	
17	2.20E-03	2.06E+01	2.07E+01	-0.665	
18	2.80E-03	1.80E+01	1.76E+01	2.557	
19	3.55E-03	1.53E+01	1.50E+01	2.181	

R: 38. X: 0. Y: 38. DL: 76. REQ: 42. CF: 1.0000
CLHZ ARRAY, 19 DATA POINTS, RAMP: 75.0 MICROSEC, DATA: MBL2S1
0802 200N 1NZ OPR L 5 8 -TXL=76*76
Ch.21 = 0.075 Ch.22 = 0.89 Ch.23 = 19 Ch.24 = 5
RMS LOG ERROR: 1.41E-02, ANTILOG YIELDS 3.2943 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	T 1
P 1	0.03		
P 2	-0.09	0.34	
T 1	-0.01	0.05	0.97


MBL2S2
MODEL:
1657.
OHM-M
148. M
2.85
OHM-M
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
Blackhawk Geosciences, Incorporated
% ERROR: 5.04
CALIBRATION: 1
OFFSET: 38 M
RAMP: 75.0

MBL2S2

MODEL: 2 LAYERS

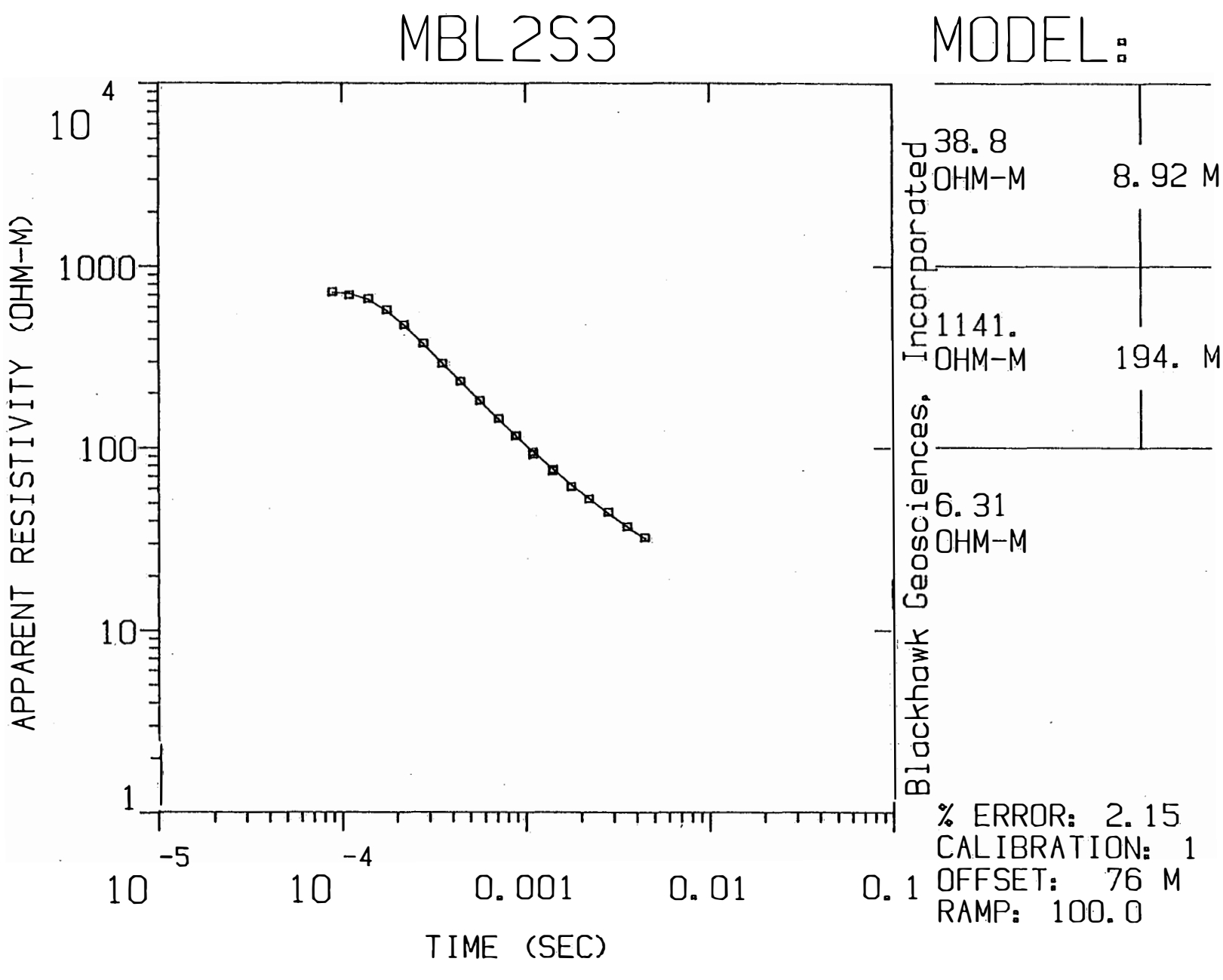
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	(FEET)	CONDUCTANCE (S) LAYER	TOTAL
		144.8	475.0		
1656.55	147.8	-3.1	-10.0	0.1	0.1
2.85					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	2.20E-04	3.07E+02	2.87E+02	6.932	
2	2.80E-04	2.22E+02	2.16E+02	2.562	
3	3.55E-04	1.64E+02	1.64E+02	-0.129	
4	4.43E-04	1.27E+02	1.28E+02	-1.177	
5	5.64E-04	9.75E+01	9.87E+01	-1.210	
6	7.13E-04	7.57E+01	7.69E+01	-1.646	
7	8.81E-04	6.06E+01	6.21E+01	-2.519	
8	8.90E-04	6.11E+01	6.15E+01	-0.684	
9	1.10E-03	4.92E+01	5.01E+01	-1.879	
10	1.10E-03	4.72E+01	4.99E+01	-5.536	
11	1.40E-03	3.87E+01	3.97E+01	-2.482	
12	1.41E-03	3.94E+01	3.94E+01	-0.061	
13	1.77E-03	3.20E+01	3.22E+01	-0.578	
14	2.20E-03	2.72E+01	2.66E+01	2.160	
15	2.80E-03	2.34E+01	2.18E+01	7.319	

R: 38. X: 0. Y: 38. DL: 76. REQ: 42. CF: 1.0000
CLHZ ARRAY, 15 DATA POINTS, RAMP: 75.0 MICROSEC, DATA: MBL2S2
0802 200N 2NZ OPR L 5 10-
Ch.21 = 0.075 Ch.22 = 0.89 Ch.23 = 19 Ch.24 = 5
RMS LOG ERROR: 2.13E-02, ANTILOG YIELDS 5.0389 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER
P 1 0.05
P 2 -0.01 0.89
T 1 0.00 0.00 1.00
P 1 P 2 T 1


MBL2S3
MODEL:
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
38.8
OHM-M
8.92 M
1141.
OHM-M
194. M
6.31
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 2.15
CALIBRATION: 1
OFFSET: 76 M
RAMP: 100.0

MBL2S3

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		175.0	574.0		
38.80	8.9	166.0	544.7	0.2	0.2
1141.01	194.1	-28.0	-91.9	0.2	0.4
6.31					

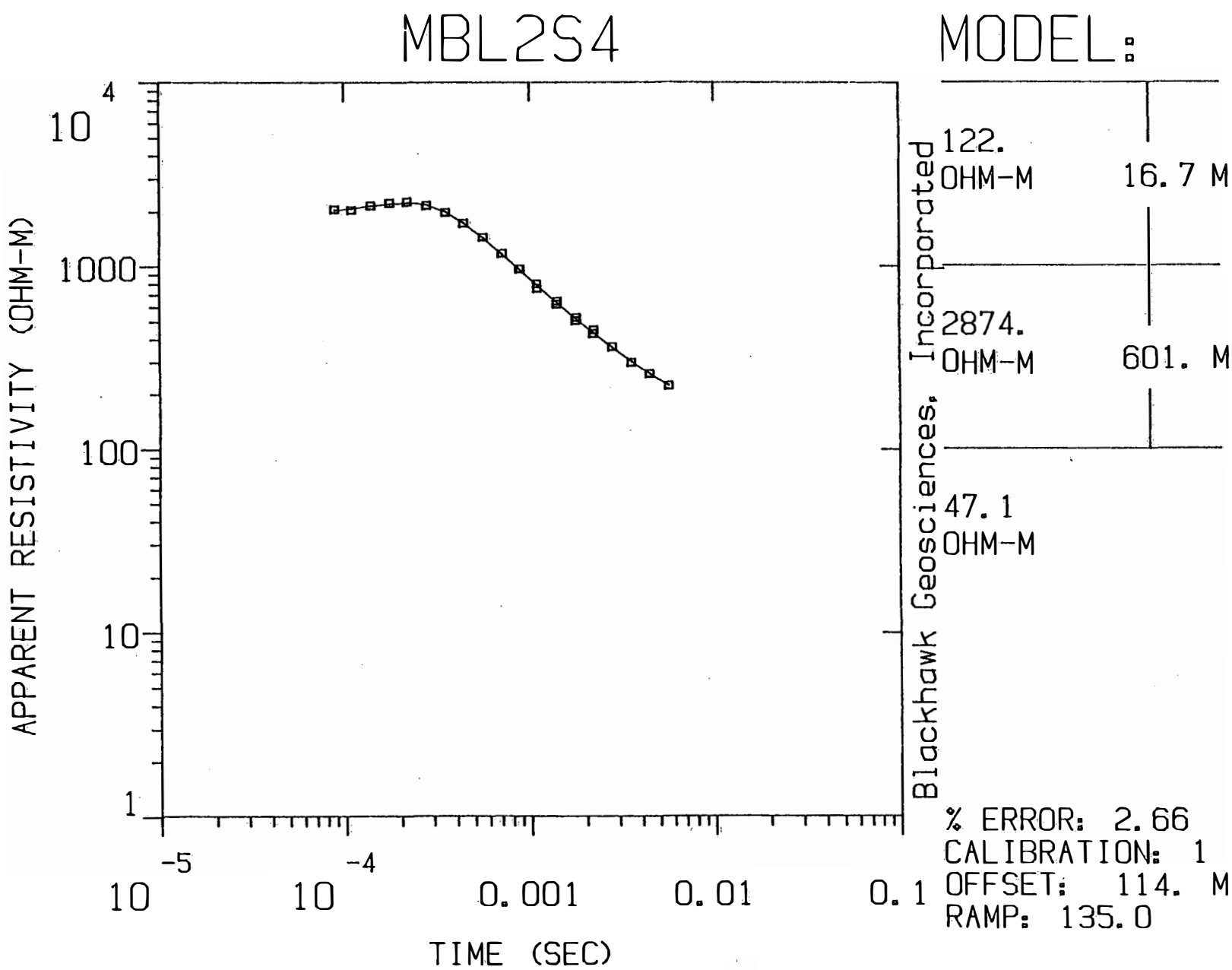
	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	7.23E+02	7.20E+02	0.485	
2	1.10E-04	6.97E+02	7.10E+02	-1.926	
3	1.40E-04	6.65E+02	6.59E+02	0.941	
4	1.77E-04	5.78E+02	5.70E+02	1.330	
5	2.20E-04	4.78E+02	4.74E+02	0.817	
6	2.80E-04	3.77E+02	3.74E+02	0.949	
7	3.55E-04	2.92E+02	2.92E+02	-0.050	
8	4.43E-04	2.32E+02	2.32E+02	0.089	
9	5.64E-04	1.81E+02	1.81E+02	0.309	
10	7.13E-04	1.45E+02	1.43E+02	1.124	
11	8.81E-04	1.16E+02	1.17E+02	-0.470	
12	8.90E-04	1.17E+02	1.15E+02	1.415	
13	1.10E-03	9.45E+01	9.51E+01	-0.635	
14	1.10E-03	9.16E+01	9.48E+01	-3.365	
15	1.40E-03	7.45E+01	7.64E+01	-2.452	
16	1.41E-03	7.59E+01	7.58E+01	0.049	
17	1.77E-03	6.11E+01	6.25E+01	-2.295	
18	2.20E-03	5.24E+01	5.24E+01	-0.126	
19	2.80E-03	4.44E+01	4.36E+01	1.791	
20	3.55E-03	3.70E+01	3.68E+01	0.525	
21	4.43E-03	3.23E+01	3.17E+01	1.827	

R: 76. X: 0. Y: 76. DL: 152. REQ: 84. CF: 1.0000
CLHZ ARRAY, 21 DATA POINTS, RAMP: 100.0 MICROSEC, DATA: MBL2S3
0802 200N 3NZ OPR L 5 10-TXL=152*152
Ch.21 = 0.1 Ch.22 = 0.89 Ch.23 = 15.5 Ch.24 = 2
RMS LOG ERROR: 9.23E-03, ANTILOG YIELDS 2.1477 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2
P 1	0.39				
P 2	0.09	0.02			
P 3	-0.04	-0.02	0.25		
T 1	-0.40	-0.10	0.06	0.43	
T 2	0.03	0.02	0.02	0.01	0.97


MBL2S4
MODEL:
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
122.
OHM-M
16.7 M
2874.
OHM-M
601. M
47.1
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 2.66
CALIBRATION: 1
OFFSET: 114. M
RAMP: 135.0

MBL2S4

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		254.8	836.0		
122.16	16.7	238.1	781.3	0.1	0.1
2874.18	600.9	-362.8	-1190.3	0.2	0.3
47.13					

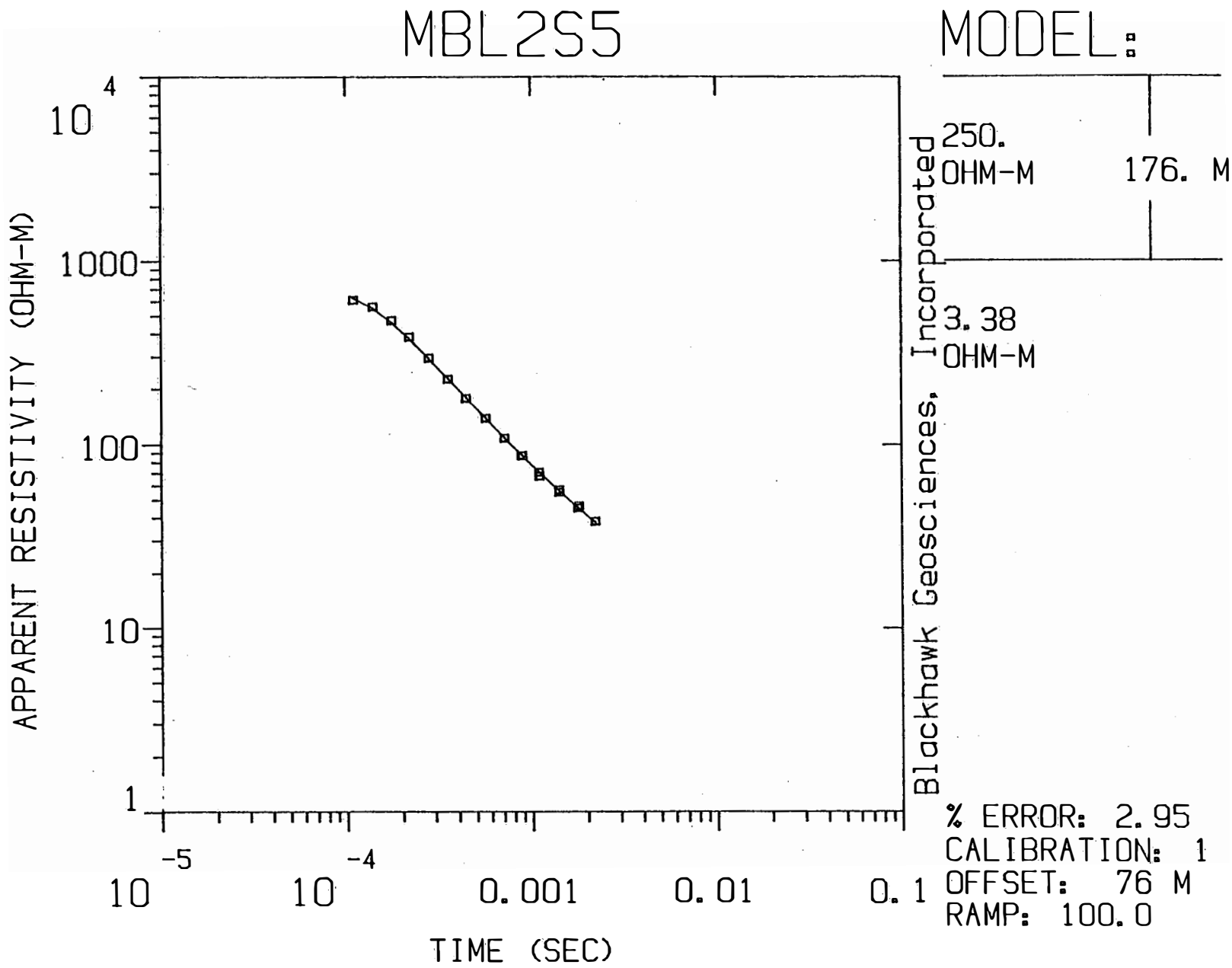
	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	2.06E+03	2.04E+03	0.863	
2	1.10E-04	2.05E+03	2.09E+03	-2.076	
3	1.40E-04	2.17E+03	2.16E+03	0.608	
4	1.77E-04	2.23E+03	2.22E+03	0.570	
5	2.20E-04	2.27E+03	2.25E+03	0.884	
6	2.80E-04	2.16E+03	2.18E+03	-0.786	
7	3.55E-04	1.98E+03	1.99E+03	-0.655	
8	4.43E-04	1.73E+03	1.74E+03	-0.511	
9	5.64E-04	1.44E+03	1.43E+03	0.782	
10	7.13E-04	1.17E+03	1.16E+03	0.735	
11	8.81E-04	9.62E+02	9.60E+02	0.167	
12	8.90E-04	9.63E+02	9.51E+02	1.226	
13	1.10E-03	7.96E+02	7.87E+02	1.077	
14	1.10E-03	7.54E+02	7.85E+02	-3.910	
15	1.40E-03	6.20E+02	6.35E+02	-2.366	
16	1.41E-03	6.42E+02	6.30E+02	1.886	
17	1.77E-03	5.04E+02	5.19E+02	-2.924	
18	1.80E-03	5.24E+02	5.13E+02	2.262	
19	2.20E-03	4.29E+02	4.34E+02	-1.345	
20	2.22E-03	4.49E+02	4.31E+02	4.339	
21	2.80E-03	3.63E+02	3.60E+02	0.874	
22	3.55E-03	2.98E+02	3.02E+02	-1.477	
23	4.43E-03	2.58E+02	2.59E+02	-0.300	
24	5.64E-03	2.22E+02	2.22E+02	-0.057	

R: 114. X: 0. Y: 115. DL: 229. REQ: 128. CF: 1.0000
CLHZ ARRAY, 24 DATA POINTS, RAMP: 135.0 MICROSEC, DATA: MBL2S4
0902 200N 44NZ OPR L 6 10-
Ch.21 = 0.135 Ch.22 = 0.89 Ch.23 = 14.5 Ch.24 =
RMS LOG ERROR: 1.14E-02, ANTILOG YIELDS 2.6616 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.56				
P 2	0.00	0.57			
P 3	0.03	-0.07	0.91		
T 1	-0.44	-0.20	0.00	0.47	
T 2	0.01	0.02	0.01	0.02	1.00
	P 1	P 2	P 3	T 1	T 2


MBL2S5
MODEL:
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
250.
OHM-M
176. M
3.38
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 2.95
CALIBRATION: 1
OFFSET: 76 M
RAMP: 100.0

MBL2S5

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		170.1	558.0		
250.03	176.4	-6.3	-20.8	0.7	0.7
3.38					

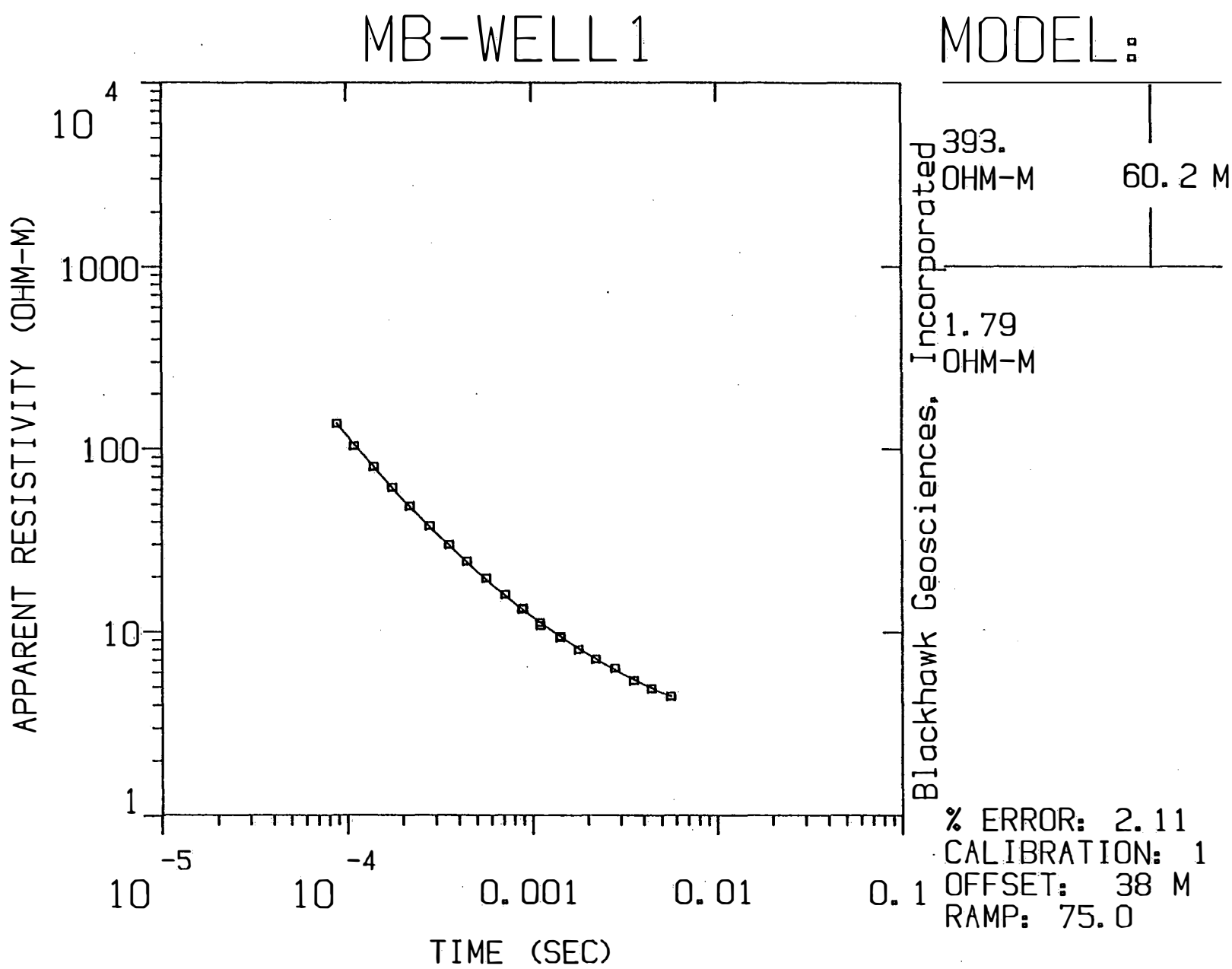
	TIMES	DATA	CALC	% ERROR	STD ERR
1	1.10E-04	6.08E+02	6.24E+02	-2.534	
2	1.40E-04	5.57E+02	5.47E+02	1.728	
3	1.77E-04	4.69E+02	4.58E+02	2.349	
4	2.20E-04	3.82E+02	3.75E+02	1.900	
5	2.80E-04	2.94E+02	2.93E+02	0.540	
6	3.55E-04	2.26E+02	2.27E+02	-0.657	
7	4.43E-04	1.77E+02	1.79E+02	-1.043	
8	5.64E-04	1.38E+02	1.39E+02	-0.426	
9	7.13E-04	1.08E+02	1.09E+02	-0.604	
10	8.81E-04	8.69E+01	8.76E+01	-0.849	
11	8.90E-04	8.69E+01	8.68E+01	0.177	
12	1.10E-03	7.06E+01	7.07E+01	-0.132	
13	1.10E-03	6.72E+01	7.04E+01	-4.555	
14	1.40E-03	5.48E+01	5.60E+01	-2.030	
15	1.41E-03	5.66E+01	5.56E+01	1.850	
16	1.77E-03	4.50E+01	4.52E+01	-0.422	
17	1.80E-03	4.63E+01	4.46E+01	3.708	
18	2.20E-03	3.80E+01	3.74E+01	1.799	

R: 76. X: 0. Y: 76. DL: 152. REQ: 84. CF: 1.0000
CLHZ ARRAY, 18 DATA POINTS, RAMP: 100.0 MICROSEC, DATA: MBL2S5
0902 200N 5NZ OPR L 5 10-TXP=5
Ch.21 = 0.1 Ch.22 = 0.89 Ch.23 = 15 Ch.24 = 231
RMS LOG ERROR: 1.26E-02, ANTILOG YIELDS 2.9478 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	1.00		
P 2	0.00	1.00	
T 1	0.00	0.00	1.00
	P 1	P 2	T 1


MB-WELL1
MODEL:
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
393.
OHM-M
60.2 M
1.79
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 2.11
CALIBRATION: 1
OFFSET: 38 M
RAMP: 75.0

MB-WELL1

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		59.7	196.0		
393.42	60.2	-0.5	-1.6	0.2	0.2
1.79					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	1.36E+02	1.37E+02	-0.283	
2	1.10E-04	1.03E+02	1.06E+02	-2.691	
3	1.40E-04	7.97E+01	7.98E+01	-0.152	
4	1.77E-04	6.14E+01	6.12E+01	0.403	
5	2.20E-04	4.87E+01	4.82E+01	0.936	
6	2.80E-04	3.78E+01	3.75E+01	1.015	
7	3.55E-04	2.98E+01	2.95E+01	0.934	
8	4.43E-04	2.42E+01	2.39E+01	1.272	
9	5.64E-04	1.96E+01	1.92E+01	1.954	
10	7.13E-04	1.59E+01	1.57E+01	1.331	
11	8.81E-04	1.32E+01	1.32E+01	-0.013	
12	8.90E-04	1.34E+01	1.31E+01	2.063	
13	1.10E-03	1.12E+01	1.12E+01	-0.198	
14	1.10E-03	1.08E+01	1.12E+01	-3.317	
15	1.40E-03	9.28E+00	9.41E+00	-1.395	
16	1.41E-03	9.41E+00	9.36E+00	0.445	
17	1.77E-03	7.97E+00	8.07E+00	-1.174	
18	2.20E-03	7.05E+00	7.06E+00	-0.211	
19	2.80E-03	6.30E+00	6.16E+00	2.203	
20	3.55E-03	5.40E+00	5.45E+00	-0.946	
21	4.43E-03	4.89E+00	4.91E+00	-0.483	
22	5.64E-03	4.44E+00	4.42E+00	0.418	

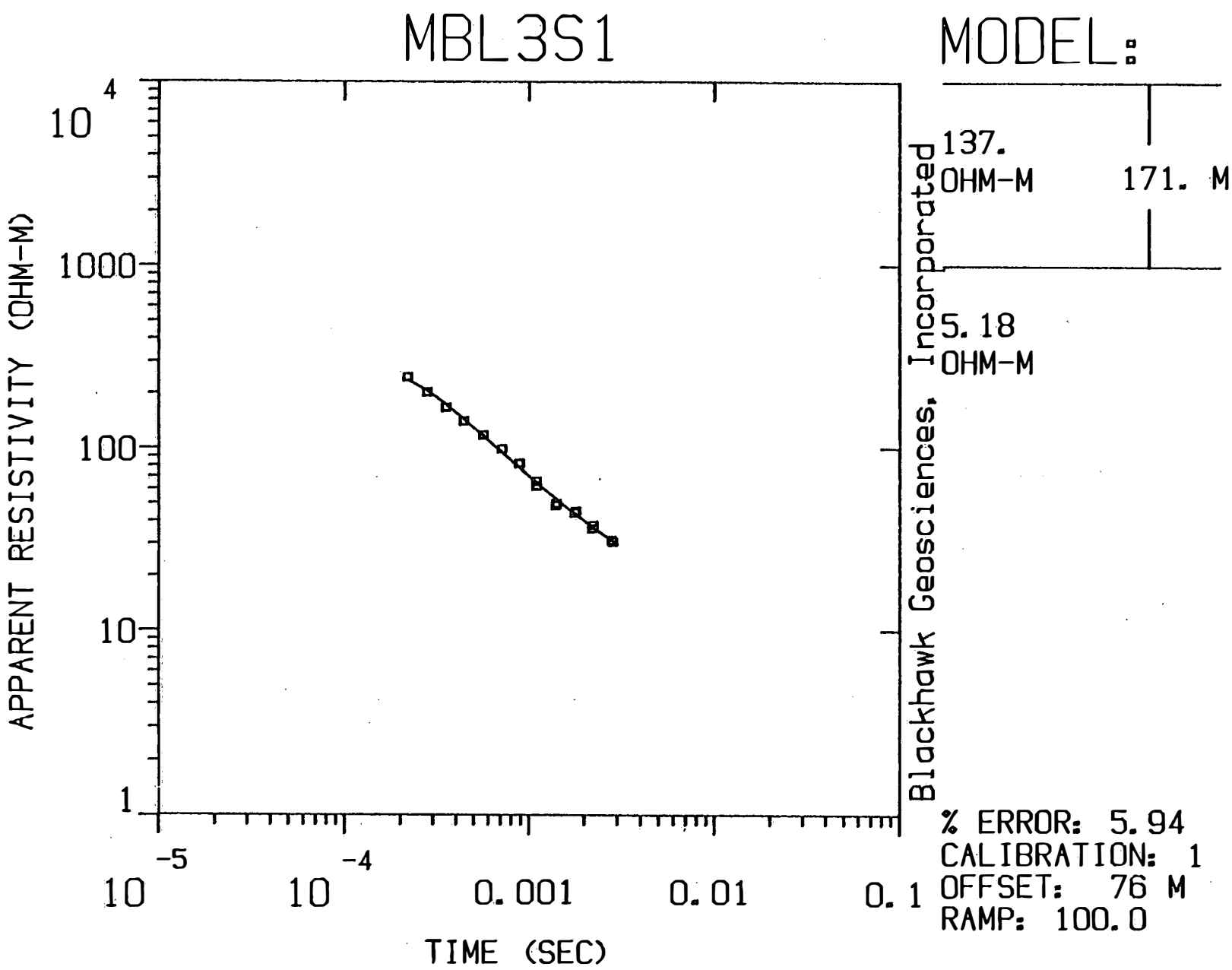
R: 38. X: 0. Y: 38. DL: 76. REQ: 42. CF: 1.0000
CLHZ ARRAY, 22 DATA POINTS, RAMP: 75.0 MICROSEC, DATA: MB-WELL1
0902 200N 6NZ OPR L 5 8 -TXP=6
Ch.21 = 0.075 Ch.22 = 0.89 Ch.23 = 19 Ch.24 = 5
RMS LOG ERROR: 9.09E-03, ANTILOG YIELDS 2.1145 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER
P 1 0.13
P 2 -0.01 1.00
T 1 0.01 0.00 1.00
P 1 P 2 T 1

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	164.535	393.419	1233.472
	2	1.717	1.788	1.891
THICK	1	59.459	60.242	60.810
DEPTH	1	59.459	60.242	60.810


MBL3S1
MODEL:
137.
OHM-M
171. M
5.18
OHM-M
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
Blackhawk Geosciences, Incorporated
% ERROR: 5.94
CALIBRATION: 1
OFFSET: 76 M
RAMP: 100.0

MBL3S1

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		150.0	492.0		
136.75	171.0	-21.0	-69.0	1.3	1.3
5.18					

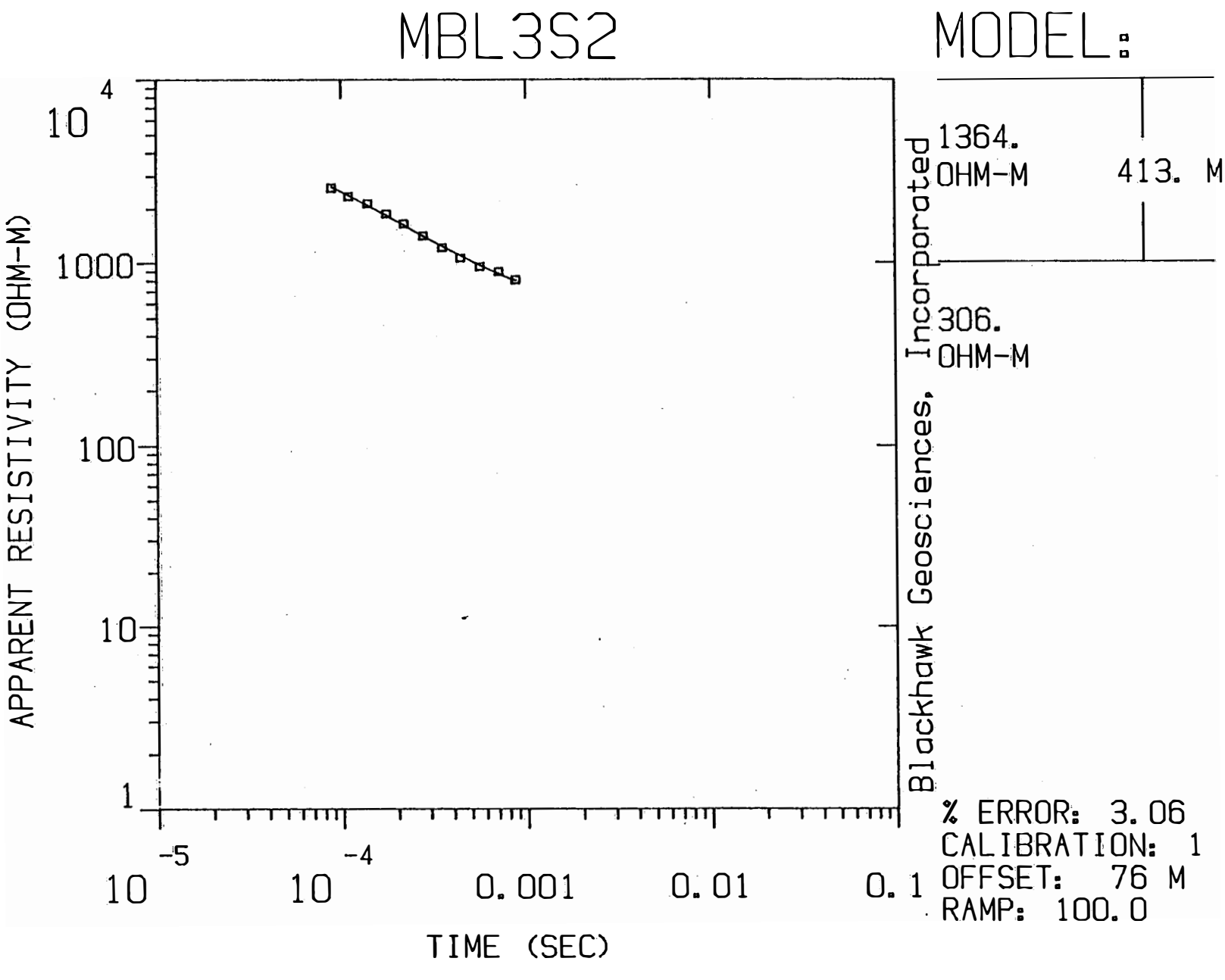
	TIMES	DATA	CALC	% ERROR	STD ERR
1	2.20E-04	2.44E+02	2.37E+02	3.217	
2	2.80E-04	2.01E+02	2.06E+02	-2.289	
3	3.55E-04	1.66E+02	1.73E+02	-3.951	
4	4.43E-04	1.40E+02	1.44E+02	-2.850	
5	5.64E-04	1.17E+02	1.16E+02	0.781	
6	7.13E-04	9.84E+01	9.41E+01	4.566	
7	8.81E-04	8.22E+01	7.80E+01	5.447	
8	8.90E-04	8.17E+01	7.73E+01	5.705	
9	1.10E-03	6.56E+01	6.45E+01	1.674	
10	1.10E-03	6.18E+01	6.43E+01	-4.013	
11	1.40E-03	4.84E+01	5.26E+01	-7.922	
12	1.41E-03	4.97E+01	5.23E+01	-4.951	
13	1.77E-03	4.41E+01	4.36E+01	1.091	
14	1.80E-03	4.50E+01	4.31E+01	4.413	
15	2.20E-03	3.61E+01	3.70E+01	-2.263	
16	2.22E-03	3.77E+01	3.67E+01	2.738	
17	2.80E-03	3.13E+01	3.11E+01	0.517	
18	2.85E-03	3.05E+01	3.07E+01	-0.845	

R: 76. X: 0. Y: 76. DL: 152. REQ: 84. CF: 1.0000
CLHZ ARRAY, 18 DATA POINTS, RAMP: 100.0 MICROSEC, DATA: MBL3S1
1002 300N 100NZ OPR L 5 10-TXL=152*152
Ch.21 = 0.1 Ch.22 = 0.89 Ch.23 = 15 Ch.24 = 231
RMS LOG ERROR: 2.51E-02, ANTILOG YIELDS 5.9386 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	T 1
P 1	1.00		
P 2	0.00	1.00	
T 1	0.00	0.00	1.00


MBL3S2
MODEL:
APPARENT RESISTIVITY (OHM-M)
10 4
1000
100
10
1
10 -5
10 -4
0.001
0.01
0.1
TIME (SEC)
1364.
OHM-M
413. M
306.
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 3.06
CALIBRATION: 1
OFFSET: 76 M
RAMP: 100.0

MBL3S2

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		246.9	810.0		
1363.71	413.0	-166.1	-545.0	0.3	0.3
306.13					

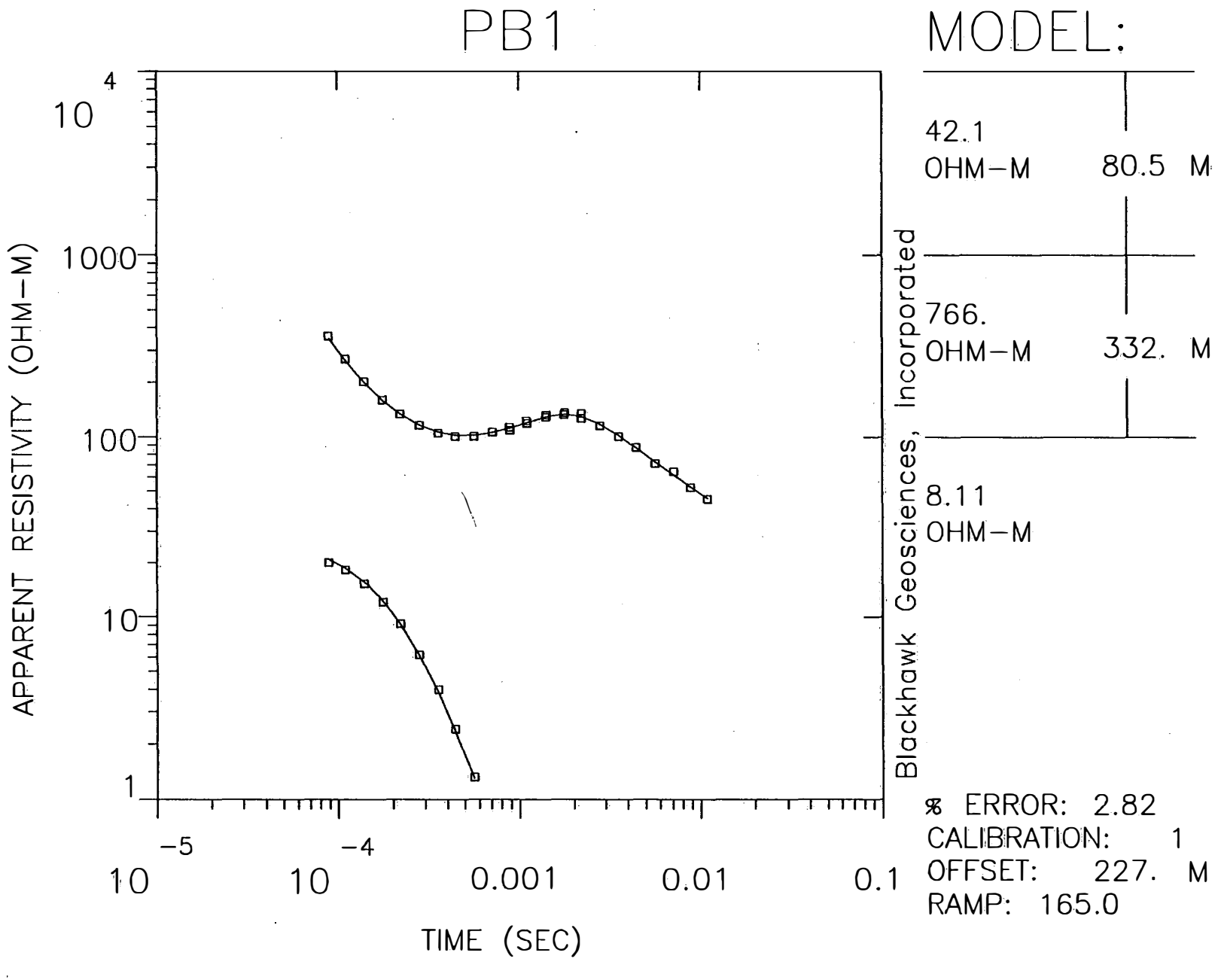
	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	2.61E+03	2.64E+03	-1.194	
2	1.10E-04	2.34E+03	2.37E+03	-1.492	
3	1.40E-04	2.14E+03	2.09E+03	2.112	
4	1.77E-04	1.88E+03	1.84E+03	2.059	
5	2.20E-04	1.65E+03	1.62E+03	1.833	
6	2.80E-04	1.42E+03	1.41E+03	0.186	
7	3.55E-04	1.22E+03	1.24E+03	-1.927	
8	4.43E-04	1.07E+03	1.10E+03	-3.422	
9	5.64E-04	9.53E+02	9.72E+02	-1.964	
10	7.13E-04	8.95E+02	8.71E+02	2.776	
11	8.81E-04	8.07E+02	7.97E+02	1.272	

R: 76. X: 0. Y: 76. DL: 152. REQ: 84. CF: 1.0000
CLHZ ARRAY, 11 DATA POINTS, RAMP: 100.0 MICROSEC, DATA: MBL3S2
1002 300N 222NZ OPR H 4 8 -
Ch.21 = 0.1 Ch.22 = 0.089 Ch.23 = 15 Ch.24 = 23
RMS LOG ERROR: 1.31E-02, ANTILOG YIELDS 3.0630 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	T 1
P 1	1.00		
P 2	-0.01	0.95	
T 1	0.01	0.02	0.99


PB1
MODEL:
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
42.1
OHM-M
80.5 M
766.
OHM-M
332. M
8.11
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 2.82
CALIBRATION: 1
OFFSET: 227. M
RAMP: 165.0

PB1

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		358.1	1175.0		
42.15	80.5	277.6	910.8	1.9	1.9
765.84	331.5	-53.9	-176.9	0.4	2.3
8.11					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	3.59E+02	3.50E+02	2.698	
2	1.10E-04	2.68E+02	2.64E+02	1.569	
3	1.40E-04	2.01E+02	1.99E+02	1.075	
4	1.77E-04	1.59E+02	1.58E+02	0.564	
5	2.20E-04	1.34E+02	1.34E+02	-0.097	
6	2.80E-04	1.16E+02	1.16E+02	-0.295	
7	3.55E-04	1.05E+02	1.07E+02	-1.679	
8	4.43E-04	1.01E+02	1.02E+02	-1.476	
9	5.64E-04	1.01E+02	1.02E+02	-1.237	
10	7.13E-04	1.07E+02	1.06E+02	0.849	
11	8.81E-04	1.13E+02	1.12E+02	1.238	
12	8.90E-04	1.09E+02	1.12E+02	-2.789	
13	1.10E-03	1.22E+02	1.20E+02	2.061	
14	1.10E-03	1.19E+02	1.20E+02	-0.882	
15	1.40E-03	1.29E+02	1.29E+02	0.141	
16	1.41E-03	1.32E+02	1.29E+02	2.230	
17	1.77E-03	1.33E+02	1.33E+02	-0.266	
18	1.80E-03	1.36E+02	1.33E+02	1.910	
19	2.20E-03	1.27E+02	1.30E+02	-2.289	
20	2.22E-03	1.34E+02	1.29E+02	3.602	
21	2.80E-03	1.15E+02	1.18E+02	-2.114	
22	3.55E-03	1.01E+02	1.02E+02	-1.485	
23	4.43E-03	8.74E+01	8.73E+01	0.062	
24	5.64E-03	7.14E+01	7.30E+01	-2.261	
25	7.13E-03	6.43E+01	6.15E+01	4.690	
26	8.81E-03	5.25E+01	5.29E+01	-0.737	
27	1.10E-02	4.53E+01	4.56E+01	-0.488	

R: 227. X: 0. Y: 228. DL: 455. REQ: 253. CF: 1.0000
CLHZ ARRAY, 27 DATA POINTS, RAMP: 165.0 MICROSEC, DATA: PB1
0508 PB 100WZ OPR XTL H 2 10+100
Ch.21 = 0.16 Ch.22 = 0.089 Ch.23 = 10.5 Ch.24 =
RMS LOG ERROR: 1.21E-02, ANTILOG YIELDS 2.8249 %
LATE TIME PARAMETERS

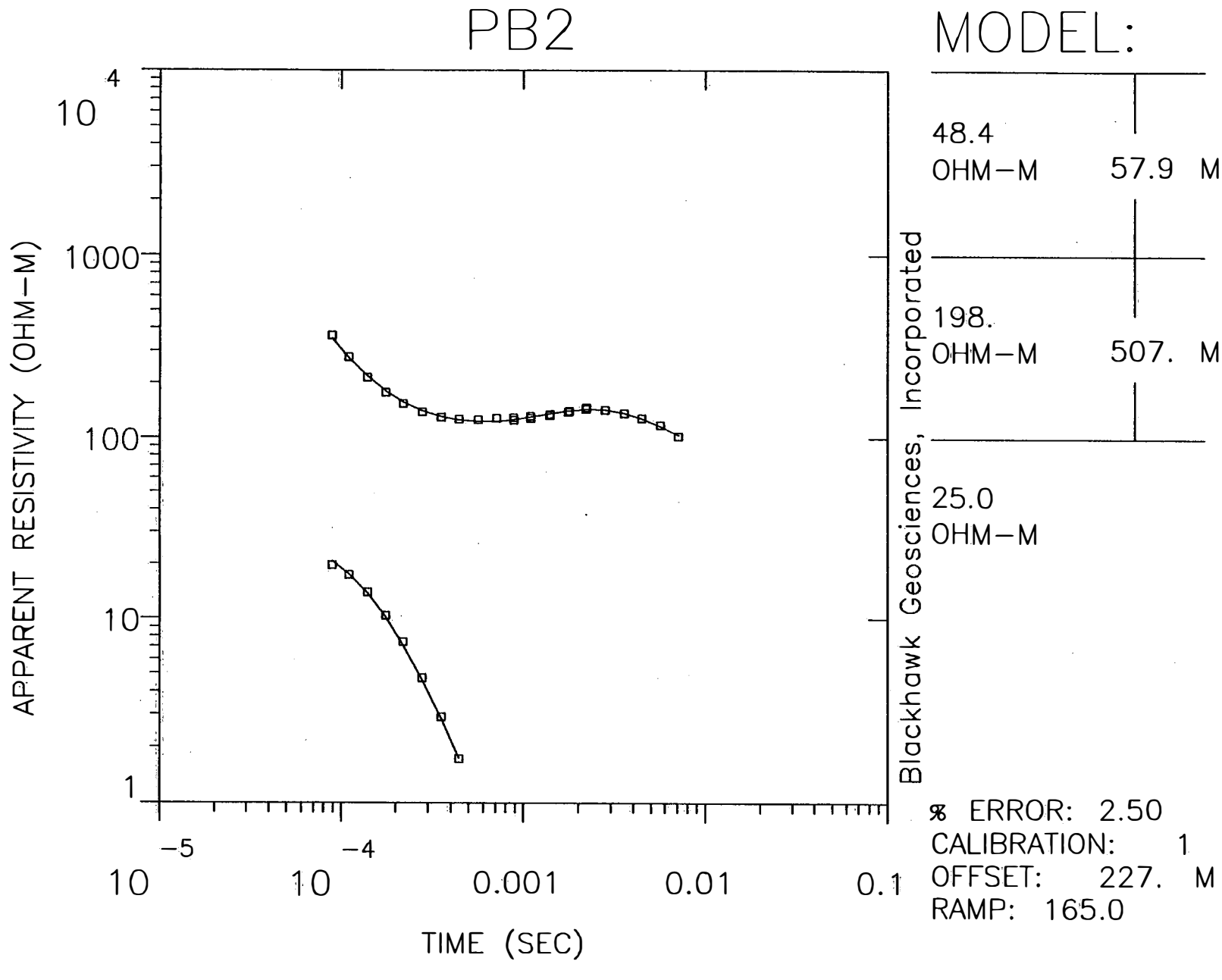
* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER
P 1 0.98
P 2 -0.01 0.03
P 3 0.02 -0.04 0.80
T 1 -0.03 -0.08 0.04 0.95

T 2 0.00 0.04 0.01 0.01 1.00
P 1 P 2 P 3 T 1 T 2

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	38.652	42.149	45.805
	2	464.285	765.841	1600.172
	3	6.521	8.114	9.826
THICK	1	70.382	80.525	92.219
	2	318.602	331.527	343.899
DEPTH	1	70.382	80.525	92.219
	2	403.790	412.051	420.353


PB2
MODEL:
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
48.4
OHM-M
57.9 M
198.
OHM-M
507. M
25.0
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 2.50
CALIBRATION: 1
OFFSET: 227. M
RAMP: 165.0

PB2

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		374.0	1227.0		
48.44	57.9	316.1	1037.1	1.2	1.2
197.94	506.9	-190.8	-625.9	2.6	3.8
25.03					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	3.63E+02	3.51E+02	3.647	
2	1.10E-04	2.77E+02	2.75E+02	0.714	
3	1.40E-04	2.15E+02	2.17E+02	-1.060	
4	1.77E-04	1.77E+02	1.80E+02	-1.995	
5	2.20E-04	1.53E+02	1.57E+02	-2.492	
6	2.80E-04	1.39E+02	1.41E+02	-1.464	
7	3.55E-04	1.29E+02	1.31E+02	-1.001	
8	4.43E-04	1.26E+02	1.25E+02	0.747	
9	5.64E-04	1.25E+02	1.23E+02	1.987	
10	7.13E-04	1.28E+02	1.23E+02	3.593	
11	8.81E-04	1.28E+02	1.25E+02	2.394	
12	8.90E-04	1.25E+02	1.26E+02	-0.369	
13	1.10E-03	1.31E+02	1.29E+02	1.037	
14	1.10E-03	1.28E+02	1.30E+02	-1.143	
15	1.40E-03	1.33E+02	1.35E+02	-1.704	
16	1.41E-03	1.34E+02	1.35E+02	-0.729	
17	1.77E-03	1.39E+02	1.40E+02	-1.081	
18	1.80E-03	1.40E+02	1.41E+02	-0.489	
19	2.20E-03	1.44E+02	1.43E+02	0.217	
20	2.22E-03	1.46E+02	1.43E+02	2.139	
21	2.80E-03	1.42E+02	1.42E+02	0.050	
22	3.55E-03	1.36E+02	1.36E+02	-0.416	
23	4.43E-03	1.28E+02	1.27E+02	0.507	
24	5.64E-03	1.17E+02	1.15E+02	1.628	
25	7.13E-03	1.02E+02	1.04E+02	-1.462	

R: 227. X: 0. Y: 228. DL: 455. REQ: 253. CF: 1.0000
CLHZ ARRAY, 25 DATA POINTS, RAMP: 165.0 MICROSEC, DATA: PB2
0608 PB 200WZ OPR XTL H 3 8 +100
Ch.21 = 0.16 Ch.22 = 0.089 Ch.23 = 10.5 Ch.24 =
RMS LOG ERROR: 1.07E-02, ANTILOG YIELDS 2.4999 %
LATE TIME PARAMETERS

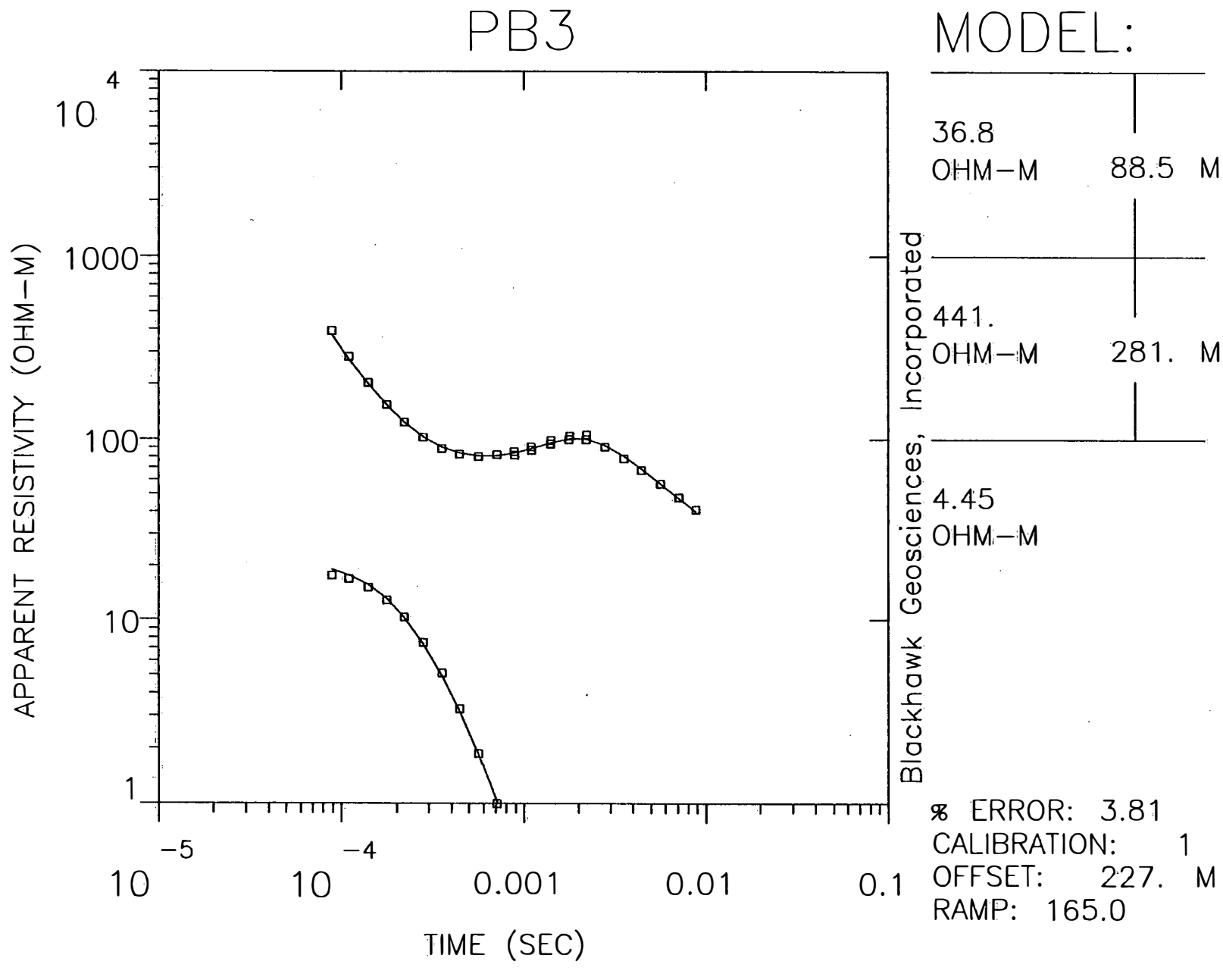
* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER
P 1 1.00
P 2 0.00 1.00
P 3 0.00 -0.01 0.98

```
T 1  0.00  0.00 -0.01  0.99
T 2  0.00  0.00  0.00  0.00  1.00
       P 1   P 2   P 3   T 1   T 2
```

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	44.667	48.440	54.615
	2	179.685	197.939	231.887
	3	17.365	25.025	36.803
THICK	1	48.343	57.891	75.585
	2	462.713	506.877	536.928
DEPTH	1	48.343	57.891	75.585
	2	532.962	564.768	589.822


PB3
MODEL:
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
36.8
OHM-M
88.5 M
441.
OHM-M
281. M
4.45
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 3.81
CALIBRATION: 1
OFFSET: 227. M
RAMP: 165.0

PB3

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		391.1	1283.0		
36.83	88.5	302.5	992.6	2.4	2.4
441.36	281.3	21.3	69.8	0.6	3.0
4.45					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	3.91E+02	3.71E+02	5.488	
2	1.10E-04	2.83E+02	2.73E+02	3.414	
3	1.40E-04	2.03E+02	1.99E+02	1.994	
4	1.77E-04	1.54E+02	1.52E+02	0.774	
5	2.20E-04	1.23E+02	1.24E+02	-0.304	
6	2.80E-04	1.02E+02	1.03E+02	-1.039	
7	3.55E-04	8.87E+01	9.06E+01	-2.139	
8	4.43E-04	8.27E+01	8.39E+01	-1.468	
9	5.64E-04	8.02E+01	8.08E+01	-0.668	
10	7.13E-04	8.23E+01	8.11E+01	1.487	
11	8.81E-04	8.54E+01	8.39E+01	1.747	
12	8.90E-04	8.18E+01	8.41E+01	-2.780	
13	1.10E-03	9.09E+01	8.88E+01	2.322	
14	1.10E-03	8.66E+01	8.89E+01	-2.613	
15	1.40E-03	9.40E+01	9.55E+01	-1.529	
16	1.41E-03	9.80E+01	9.57E+01	2.418	
17	1.77E-03	9.97E+01	1.00E+02	-0.462	
18	1.80E-03	1.04E+02	1.00E+02	3.430	
19	2.20E-03	9.96E+01	9.99E+01	-0.337	
20	2.22E-03	1.06E+02	9.98E+01	5.960	
21	2.80E-03	9.08E+01	9.29E+01	-2.184	
22	3.55E-03	7.83E+01	8.11E+01	-3.457	
23	4.43E-03	6.77E+01	6.91E+01	-2.000	
24	5.64E-03	5.68E+01	5.70E+01	-0.390	
25	7.13E-03	4.78E+01	4.72E+01	1.244	
26	8.81E-03	4.10E+01	4.00E+01	2.617	

R: 227. X: 0. Y: 228. DL: 455. REQ: 253. CF: 1.0000
CLHZ ARRAY, 26 DATA POINTS, RAMP: 165.0 MICROSEC, DATA: PB3
0608 PB 300WZ OPR XTL H 3 8 +100
Ch.21 = 0.165 Ch.22 = 0.089 Ch.23 = 11 Ch.24 =
RMS LOG ERROR: 1.62E-02, ANTILOG YIELDS 3.8056 %
LATE TIME PARAMETERS

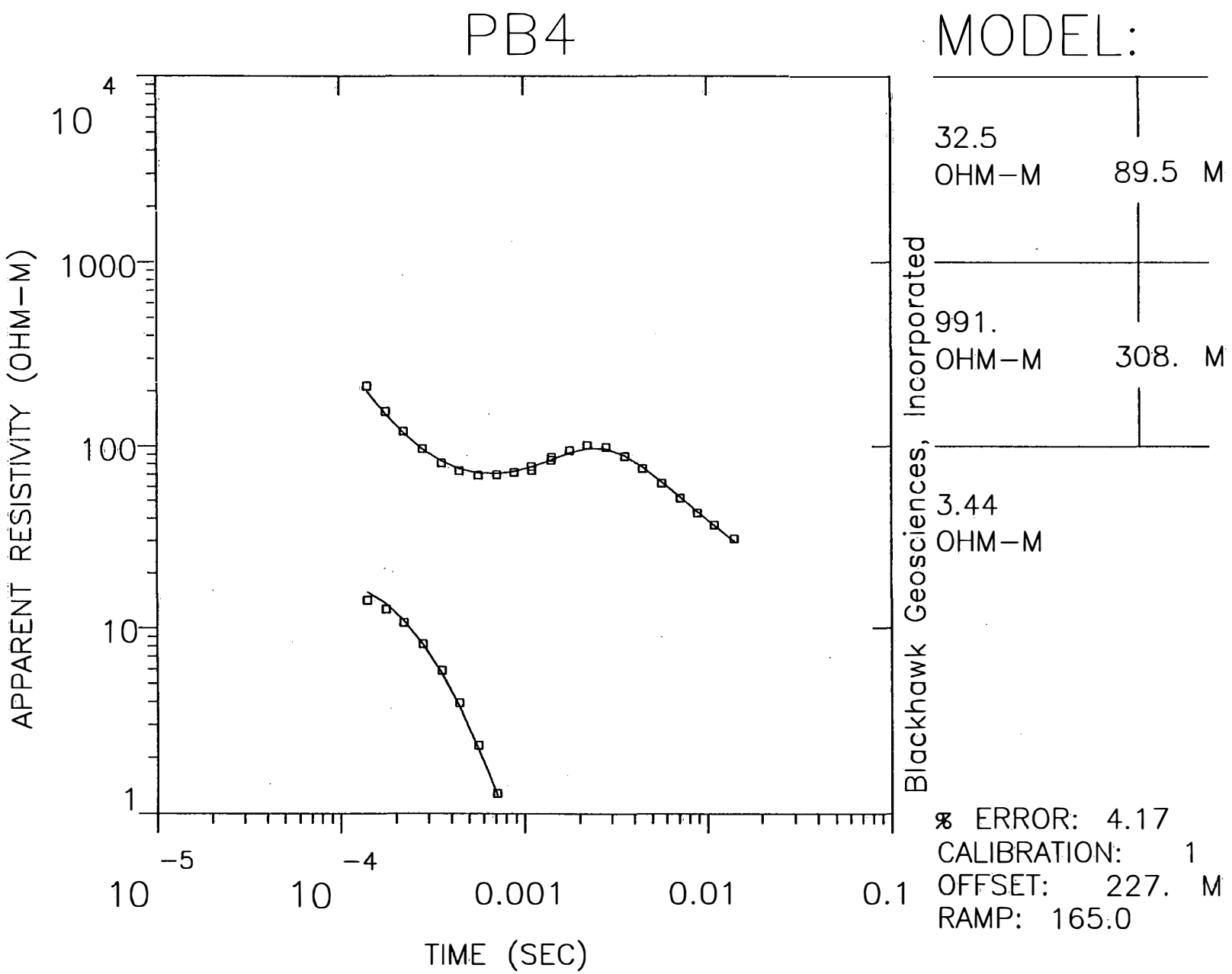
* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER
P 1 0.99
P 2 -0.01 0.04

P 3	0.02	-0.07	0.67		
T 1	-0.02	-0.10	0.04	0.95	
T 2	0.01	0.05	-0.01	0.01	0.99
	P 1	P 2	P 3	T 1	T 2

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	33.029	36.834	40.568
	2	248.196	441.361	923.653
	3	3.032	4.447	6.522
THICK	1	74.290	88.527	105.594
	2	262.524	281.262	298.730
DEPTH	1	74.290	88.527	105.594
	2	364.796	369.789	376.766


PB4
MODEL:
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
32.5
OHM-M
89.5 M
991.
OHM-M
308. M
3.44
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 4.17
CALIBRATION: 1
OFFSET: 227. M
RAMP: 165.0

PB4

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		363.9	1194.0		
32.55	89.5	274.4	900.4	2.7	2.7
990.69	307.6	-33.1	-108.7	0.3	3.1
3.44					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	1.40E-04	2.12E+02	1.99E+02	6.855	
2	1.77E-04	1.55E+02	1.49E+02	4.315	
3	2.20E-04	1.21E+02	1.18E+02	2.021	
4	2.80E-04	9.62E+01	9.62E+01	-0.023	
5	3.55E-04	8.07E+01	8.27E+01	-2.379	
6	4.43E-04	7.32E+01	7.52E+01	-2.729	
7	5.64E-04	6.92E+01	7.12E+01	-2.771	
8	7.13E-04	6.97E+01	7.06E+01	-1.221	
9	8.81E-04	7.19E+01	7.25E+01	-0.869	
10	1.10E-03	7.73E+01	7.69E+01	0.506	
11	1.10E-03	7.36E+01	7.70E+01	-4.345	
12	1.40E-03	8.36E+01	8.40E+01	-0.542	
13	1.41E-03	8.67E+01	8.43E+01	2.819	
14	1.77E-03	9.48E+01	9.18E+01	3.288	
15	2.20E-03	1.01E+02	9.71E+01	4.240	
16	2.80E-03	9.87E+01	9.67E+01	2.160	
17	3.55E-03	8.79E+01	8.86E+01	-0.747	
18	4.43E-03	7.56E+01	7.69E+01	-1.653	
19	5.64E-03	6.26E+01	6.36E+01	-1.527	
20	7.13E-03	5.18E+01	5.22E+01	-0.782	
21	8.81E-03	4.29E+01	4.36E+01	-1.681	
22	1.10E-02	3.67E+01	3.64E+01	0.883	
23	1.41E-02	3.07E+01	2.97E+01	3.329	

R: 227. X: 0. Y: 228. DL: 455. REQ: 253. CF: 1.0000
CLHZ ARRAY, 23 DATA POINTS, RAMP: 165.0 MICROSEC, DATA: PB4
0807 PB 400WZ OPR XTL H 3 8 +100
Ch.21 = 0.165 Ch.22 = 0.089 Ch.23 = 11 Ch.24 =
RMS LOG ERROR: 1.77E-02, ANTILOG YIELDS 4.1676 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

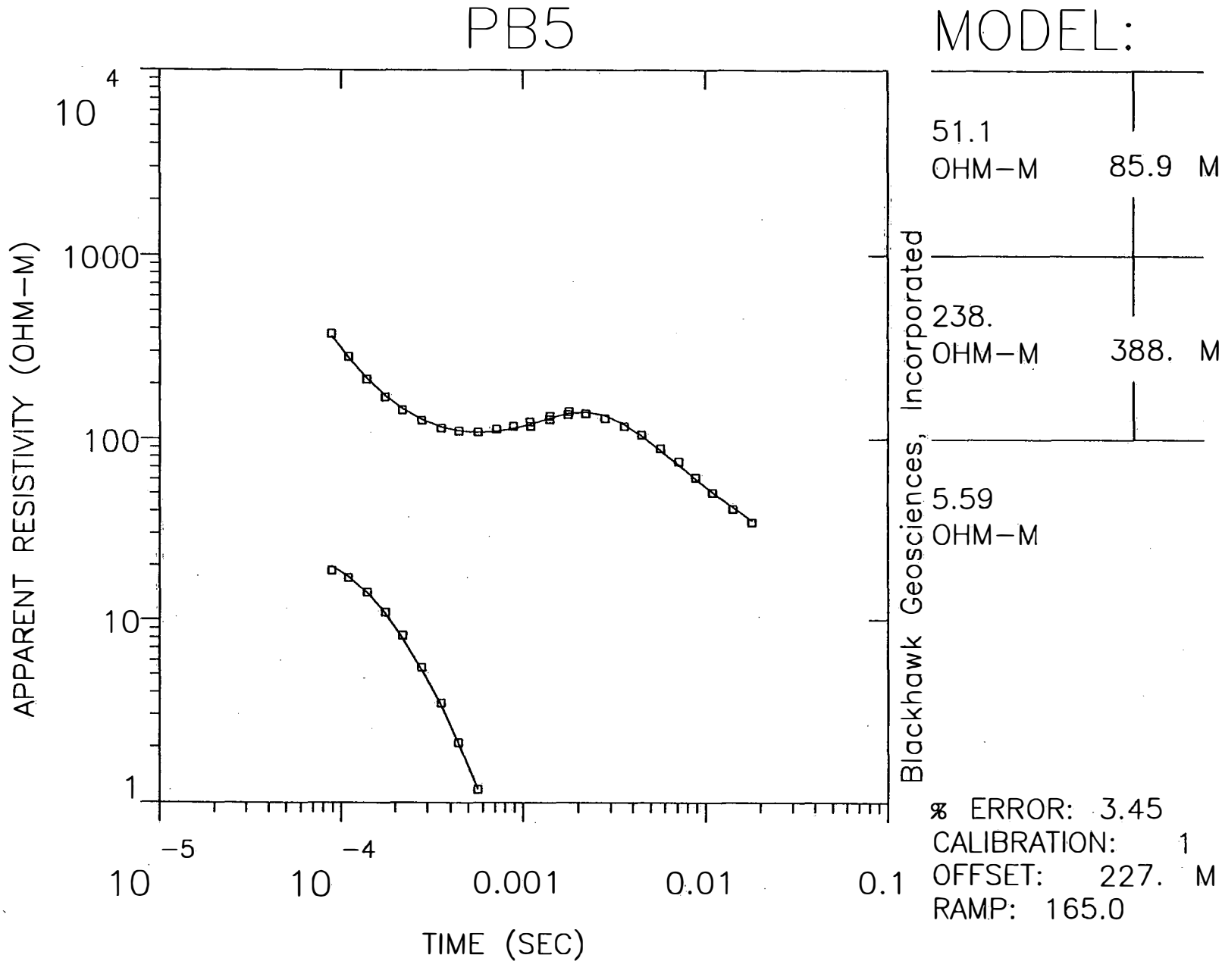
PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.98				
P 2	0.00	0.01			
P 3	0.02	-0.02	0.73		
T 1	-0.02	-0.04	0.04	0.96	
T 2	0.00	0.02	0.00	0.01	1.00

P 1 P 2 P 3 T 1 T 2

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	28.923	32.549	36.085
	2	403.467	990.690	3132.836
	3	2.333	3.438	4.680
THICK	1	75.114	89.483	104.255
	2	291.324	307.581	320.962
DEPTH	1	75.114	89.483	104.255
	2	392.295	397.064	402.359


PB5
MODEL:
APPARENT RESISTIVITY (OHM-M)
10 4
1000
100
10
1
10 -5
10 -4
0.001
0.01
0.1
TIME (SEC)
51.1
OHM-M
85.9 M
238.
OHM-M
388. M
5.59
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 3.45
CALIBRATION: 1
OFFSET: 227. M
RAMP: 165.0

PB5

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		363.9	1194.0		
51.15	85.9	278.0	912.1	1.7	1.7
237.95	388.2	-110.2	-361.5	1.6	3.3
5.59					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	3.74E+02	3.61E+02	3.533	
2	1.10E-04	2.80E+02	2.78E+02	0.881	
3	1.40E-04	2.12E+02	2.13E+02	-0.627	
4	1.77E-04	1.70E+02	1.72E+02	-1.495	
5	2.20E-04	1.43E+02	1.47E+02	-2.204	
6	2.80E-04	1.26E+02	1.28E+02	-1.532	
7	3.55E-04	1.15E+02	1.17E+02	-1.583	
8	4.43E-04	1.10E+02	1.11E+02	-0.227	
9	5.64E-04	1.09E+02	1.08E+02	0.765	
10	7.13E-04	1.13E+02	1.10E+02	2.712	
11	8.81E-04	1.17E+02	1.14E+02	2.745	
12	1.10E-03	1.24E+02	1.21E+02	2.871	
13	1.10E-03	1.18E+02	1.21E+02	-2.620	
14	1.40E-03	1.28E+02	1.30E+02	-1.494	
15	1.41E-03	1.33E+02	1.30E+02	2.489	
16	1.77E-03	1.36E+02	1.38E+02	-1.242	
17	1.80E-03	1.41E+02	1.38E+02	2.505	
18	2.20E-03	1.37E+02	1.40E+02	-2.171	
19	2.80E-03	1.29E+02	1.34E+02	-3.905	
20	3.55E-03	1.17E+02	1.20E+02	-2.629	
21	4.43E-03	1.05E+02	1.04E+02	0.872	
22	5.64E-03	8.87E+01	8.63E+01	2.700	
23	7.13E-03	7.48E+01	7.15E+01	4.614	
24	8.81E-03	6.10E+01	6.03E+01	1.267	
25	1.10E-02	5.07E+01	5.07E+01	-0.124	
26	1.41E-02	4.11E+01	4.19E+01	-2.051	
27	1.80E-02	3.45E+01	3.53E+01	-2.184	

R: 227. X: 0. Y: 228. DL: 455. REQ: 253. CF: 1.0000
CLHZ ARRAY, 27 DATA POINTS, RAMP: 165.0 MICROSEC, DATA: PB5
0807 PB 500WZ OPR XTL H 3 8 +100
Ch.21 = 0.165 Ch.22 = 0.089 Ch.23 = 11 Ch.24 =
RMS LOG ERROR: 1.47E-02, ANTILOG YIELDS 3.4534 %
LATE TIME PARAMETERS

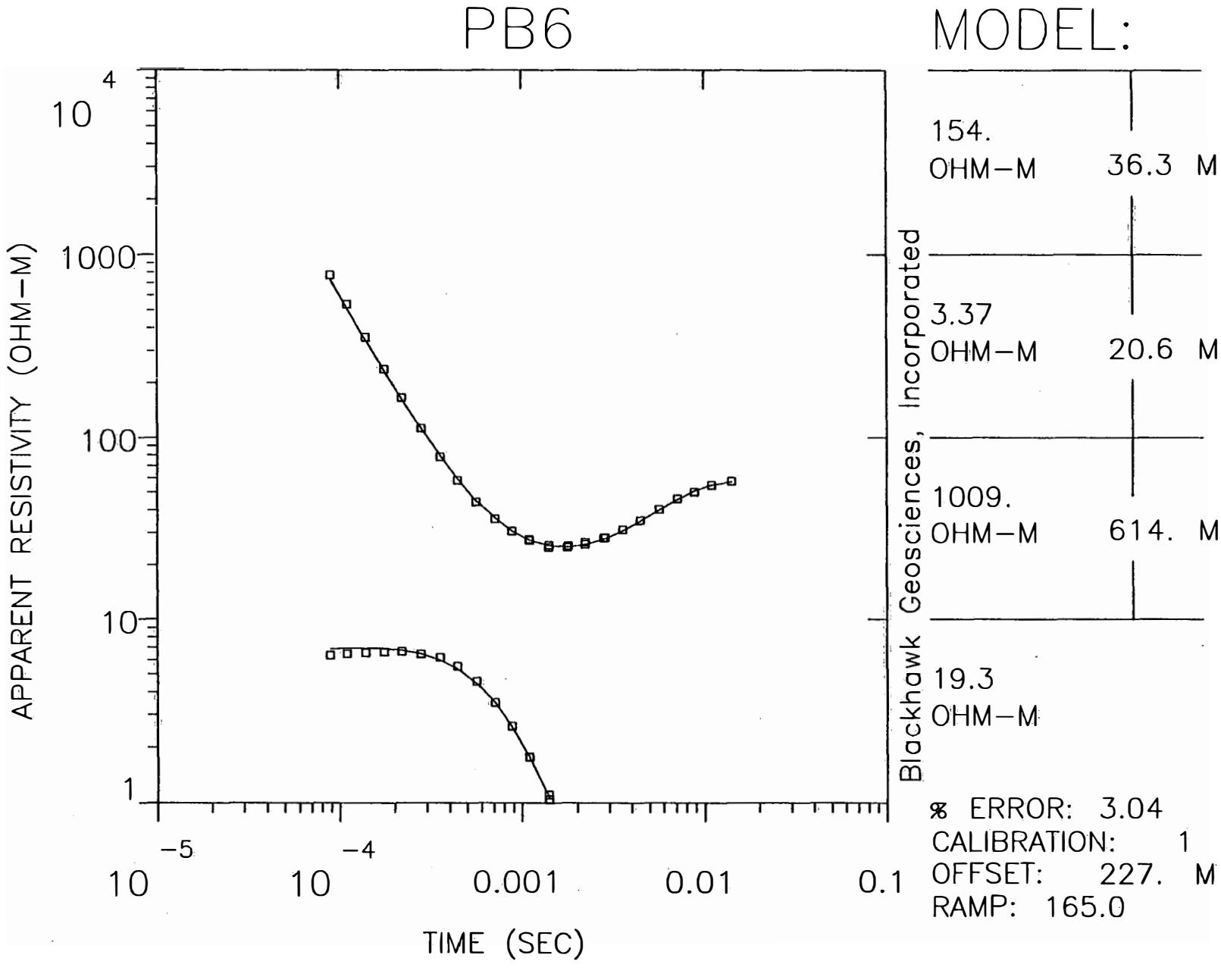
* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER
P 1 1.00

P 2	0.00	0.97			
P 3	0.00	-0.01	1.00		
T 1	0.00	-0.01	0.00	0.99	
T 2	0.00	0.00	0.00	0.00	1.00
	P 1	P 2	P 3	T 1	T 2

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	48.739	51.148	54.885
	2	191.301	237.950	342.981
	3	4.658	5.589	7.095
THICK	1	74.444	85.916	105.944
	2	366.002	388.199	403.518
DEPTH	1	74.444	85.916	105.944
	2	466.903	474.115	480.594


PB6
MODEL:
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
154.
OHM-M
36.3 M
3.37
OHM-M
20.6 M
1009.
OHM-M
614. M
19.3
OHM-M
% ERROR: 3.04
CALIBRATION: 1
OFFSET: 227. M
RAMP: 165.0
Blackhawk Geosciences, Incorporated

PB6

MODEL: 4 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		362.1	1188.0		
153.52	36.3	325.8	1069.0	0.2	0.2
3.37	20.6	305.2	1001.4	6.1	6.3
1008.97	614.2	-309.0	-1013.8	0.6	7.0
19.29					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	7.72E+02	7.29E+02	5.928	
2	1.10E-04	5.34E+02	5.11E+02	4.588	
3	1.40E-04	3.54E+02	3.41E+02	3.813	
4	1.77E-04	2.38E+02	2.32E+02	2.701	
5	2.20E-04	1.65E+02	1.63E+02	1.159	
6	2.80E-04	1.13E+02	1.13E+02	-0.029	
7	3.55E-04	7.81E+01	7.98E+01	-2.059	
8	4.43E-04	5.82E+01	5.95E+01	-2.141	
9	5.64E-04	4.42E+01	4.49E+01	-1.681	
10	7.13E-04	3.57E+01	3.59E+01	-0.470	
11	8.81E-04	3.06E+01	3.07E+01	-0.115	
12	1.10E-03	2.75E+01	2.74E+01	0.491	
13	1.10E-03	2.72E+01	2.73E+01	-0.458	
14	1.40E-03	2.49E+01	2.55E+01	-2.033	
15	1.41E-03	2.56E+01	2.54E+01	0.844	
16	1.77E-03	2.49E+01	2.51E+01	-0.487	
17	1.80E-03	2.54E+01	2.51E+01	1.213	
18	2.20E-03	2.59E+01	2.58E+01	0.631	
19	2.22E-03	2.65E+01	2.58E+01	2.557	
20	2.80E-03	2.80E+01	2.77E+01	1.347	
21	2.85E-03	2.81E+01	2.79E+01	1.035	
22	3.55E-03	3.11E+01	3.07E+01	1.210	
23	4.43E-03	3.51E+01	3.46E+01	1.360	
24	5.64E-03	4.02E+01	3.99E+01	0.678	
25	7.13E-03	4.60E+01	4.58E+01	0.534	
26	8.81E-03	5.02E+01	5.10E+01	-1.498	
27	1.10E-02	5.48E+01	5.51E+01	-0.548	
28	1.41E-02	5.76E+01	5.72E+01	0.712	

R: 227. X: 0. Y: 228. DL: 455. REQ: 253. CF: 1.0000
CLHZ ARRAY, 28 DATA POINTS, RAMP: 165.0 MICROSEC, DATA: PB6
0807 PB 600WZ OPR XTL H 3 8 +100
Ch.21 = 0.165 Ch.22 = 0.089 Ch.23 = 11 Ch.24 =
RMS LOG ERROR: 1.30E-02, ANTILOG YIELDS 3.0402 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

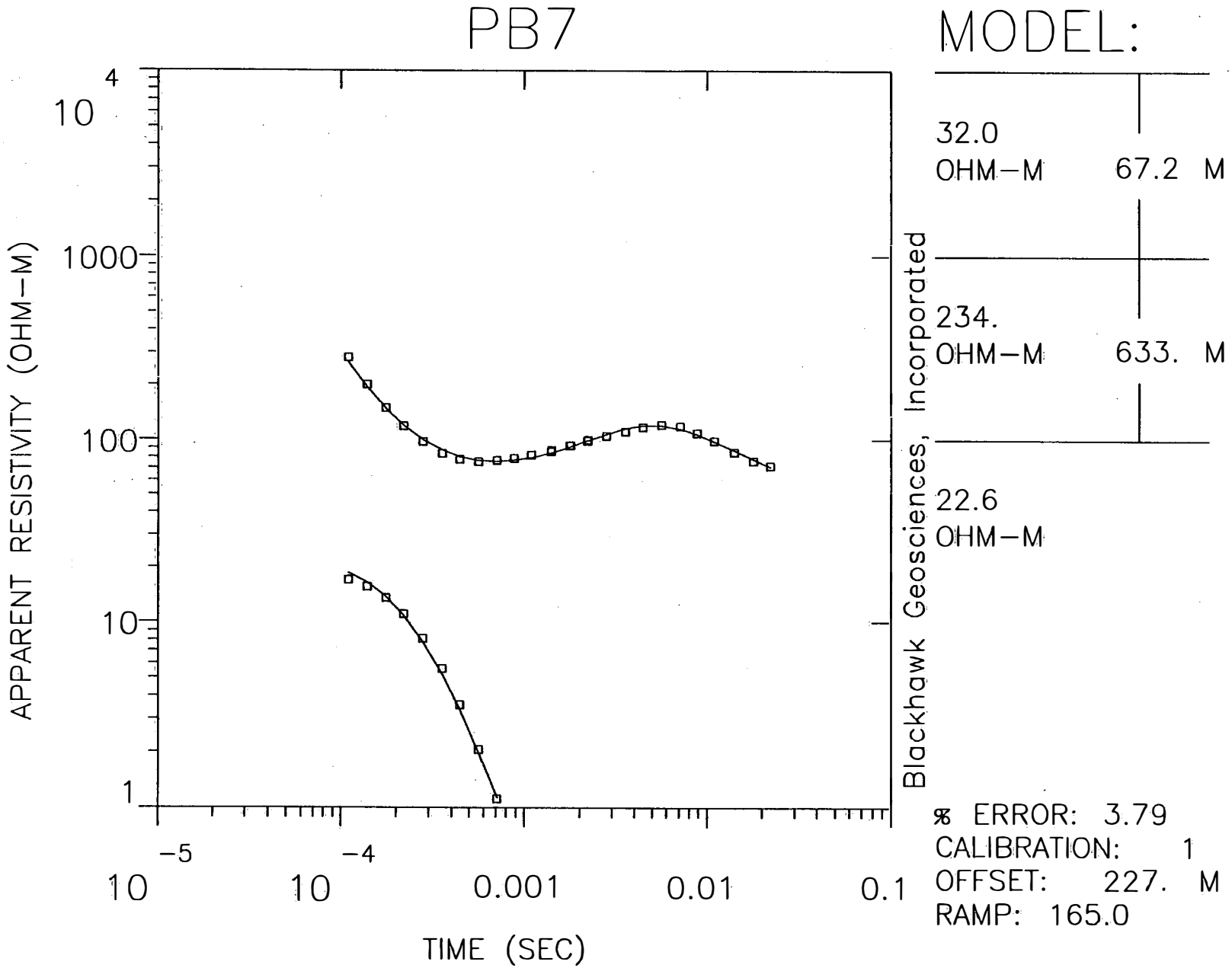
PARAMETER RESOLUTION MATRIX:

"F" MEANS FIXED PARAMETER

P 1	0.01						
P 2	0.01	0.65					
P 3	0.01	-0.03	0.02				
P 4	-0.01	0.05	-0.02	0.07			
T 1	0.05	0.17	0.01	-0.01	0.89		
T 2	-0.03	-0.36	-0.05	0.05	0.17	0.62	
T 3	0.01	-0.09	0.04	0.11	0.04	-0.10	0.93
	P 1	P 2	P 3	P 4	T 1	T 2	T 3

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	82.534	153.520	409.053
	2	2.765	3.371	4.299
	3	567.385	1008.970	3190.643
	4	8.979	19.289	49.920
THICK	1	32.147	36.261	39.953
	2	16.756	20.606	26.621
	3	549.097	614.243	672.192
DEPTH	1	32.147	36.261	39.953
	2	55.525	56.867	58.954
	3	605.362	671.109	729.595


PB7
MODEL:
APPARENT RESISTIVITY (OHM-M)
10 4
1000
100
10
1
10 -5
10 -4
0.001
0.01
0.1
TIME (SEC)
32.0
OHM-M
67.2 M
234.
OHM-M
633. M
22.6
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 3.79
CALIBRATION: 1
OFFSET: 227. M
RAMP: 165.0

PB7

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		335.0	1099.0		
32.03	67.2	267.7	878.4	2.1	2.1
233.87	632.5	-364.8	-1196.9	2.7	4.8
22.62					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	1.10E-04	2.81E+02	2.65E+02	5.775	
2	1.40E-04	1.99E+02	1.93E+02	3.326	
3	1.77E-04	1.48E+02	1.47E+02	0.882	
4	2.20E-04	1.18E+02	1.19E+02	-1.156	
5	2.80E-04	9.69E+01	9.95E+01	-2.658	
6	3.55E-04	8.38E+01	8.74E+01	-4.064	
7	4.43E-04	7.79E+01	8.06E+01	-3.264	
8	5.64E-04	7.53E+01	7.67E+01	-1.879	
9	7.13E-04	7.66E+01	7.58E+01	1.087	
10	8.81E-04	7.85E+01	7.68E+01	2.192	
11	1.10E-03	8.22E+01	7.96E+01	3.240	
12	1.40E-03	8.58E+01	8.45E+01	1.501	
13	1.41E-03	8.71E+01	8.47E+01	2.851	
14	1.77E-03	9.26E+01	9.10E+01	1.710	
15	1.80E-03	9.30E+01	9.14E+01	1.714	
16	2.20E-03	9.83E+01	9.83E+01	-0.012	
17	2.22E-03	9.93E+01	9.87E+01	0.622	
18	2.80E-03	1.04E+02	1.07E+02	-2.499	
19	3.55E-03	1.10E+02	1.15E+02	-3.792	
20	4.43E-03	1.16E+02	1.19E+02	-2.364	
21	5.64E-03	1.20E+02	1.19E+02	0.886	
22	7.13E-03	1.18E+02	1.14E+02	3.073	
23	8.81E-03	1.08E+02	1.07E+02	1.290	
24	1.10E-02	9.83E+01	9.76E+01	0.752	
25	1.41E-02	8.51E+01	8.70E+01	-2.181	
26	1.80E-02	7.62E+01	7.78E+01	-2.021	
27	2.22E-02	7.16E+01	7.06E+01	1.382	

R: 227. X: 0. Y: 228. DL: 455. REQ: 253. CF: 1.0000
CLHZ ARRAY, 27 DATA POINTS, RAMP: 165.0 MICROSEC, DATA: PB7
0808 PB 700WZ OPR XTL L 6 8 +100 2
Ch.21 = 0.165 Ch.22 = 0.89 Ch.23 = 11 Ch.24 = 2
RMS LOG ERROR: 1.61E-02, ANTILOG YIELDS 3.7879 %
LATE TIME PARAMETERS

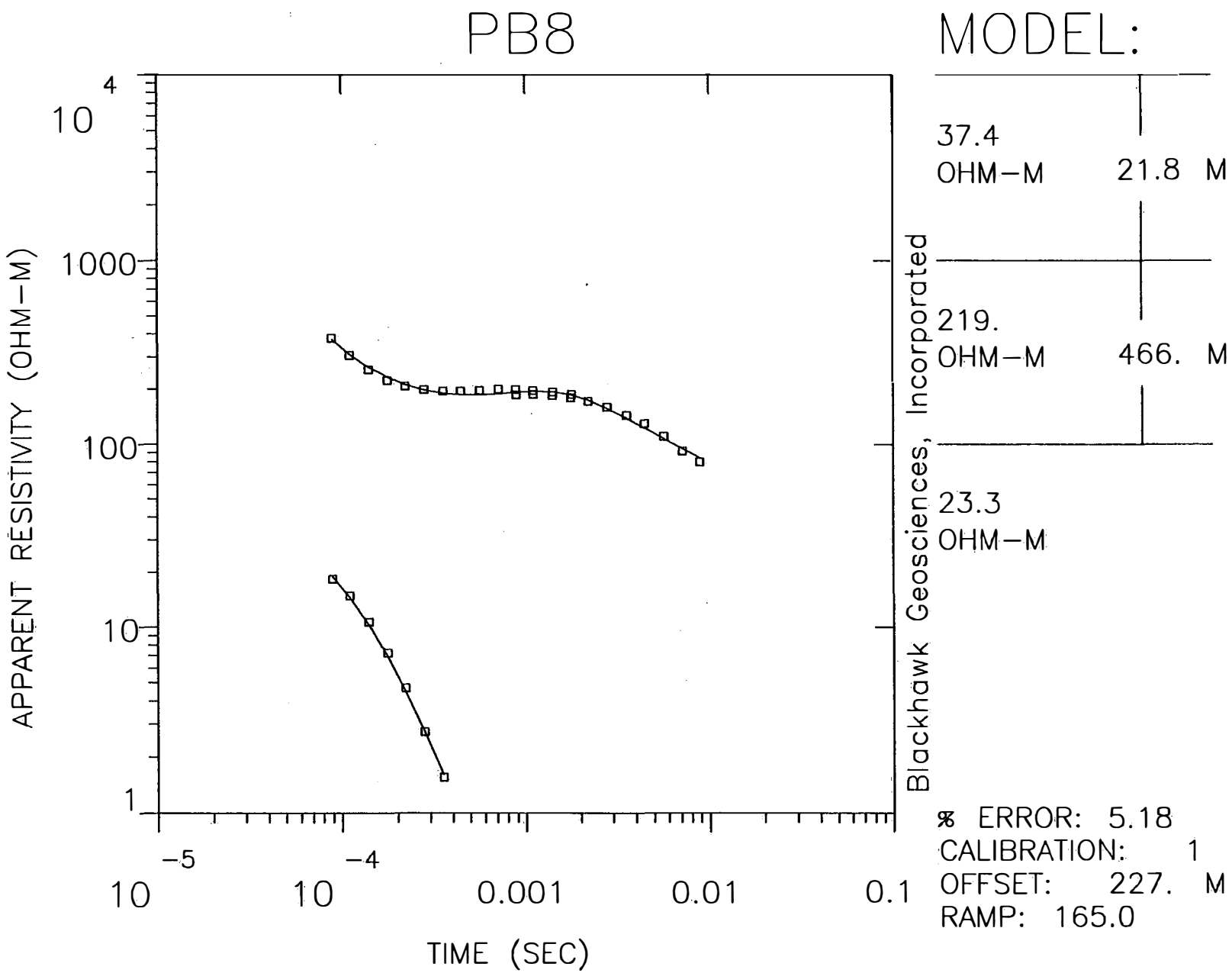
* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER
P 1 1.00

```
P 2   0.00   0.99
P 3   0.00   0.00   0.99
T 1   0.00   0.00   0.00   1.00
T 2   0.00   0.00   0.00   0.00   1.00
        P 1    P 2    P 3    T 1    T 2
```

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	28.460	32.029	36.443
	2	189.047	233.874	307.897
	3	15.706	22.617	30.115
THICK	1	53.840	67.249	85.746
	2	571.088	632.534	693.244
DEPTH	1	53.840	67.249	85.746
	2	648.582	699.783	755.709


PB8
MODEL:
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
37.4
OHM-M
21.8 M
219.
OHM-M
466. M
23.3
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 5.18
CALIBRATION: 1
OFFSET: 227. M
RAMP: 165.0

PB8

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		392.0	1286.0		
37.40	21.8	370.2	1214.6	0.6	0.6
218.70	465.7	-95.5	-313.2	2.1	2.7
23.33					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	3.79E+02	3.73E+02	1.597	
2	1.10E-04	3.06E+02	3.11E+02	-1.560	
3	1.40E-04	2.55E+02	2.63E+02	-2.943	
4	1.77E-04	2.24E+02	2.32E+02	-3.522	
5	2.20E-04	2.08E+02	2.13E+02	-2.439	
6	2.80E-04	1.99E+02	1.99E+02	0.339	
7	3.55E-04	1.95E+02	1.90E+02	2.339	
8	4.43E-04	1.96E+02	1.87E+02	4.812	
9	5.64E-04	1.97E+02	1.86E+02	5.695	
10	7.13E-04	2.00E+02	1.89E+02	6.085	
11	8.81E-04	1.99E+02	1.92E+02	3.493	
12	8.90E-04	1.86E+02	1.92E+02	-2.969	
13	1.10E-03	1.97E+02	1.94E+02	1.202	
14	1.10E-03	1.87E+02	1.94E+02	-3.840	
15	1.40E-03	1.85E+02	1.93E+02	-4.386	
16	1.41E-03	1.92E+02	1.93E+02	-0.442	
17	1.77E-03	1.79E+02	1.86E+02	-3.720	
18	1.80E-03	1.87E+02	1.86E+02	0.748	
19	2.20E-03	1.71E+02	1.74E+02	-1.703	
20	2.80E-03	1.59E+02	1.57E+02	1.302	
21	3.55E-03	1.44E+02	1.39E+02	3.507	
22	4.43E-03	1.29E+02	1.23E+02	5.382	
23	5.64E-03	1.10E+02	1.07E+02	3.026	
24	7.13E-03	9.17E+01	9.43E+01	-2.729	
25	8.81E-03	8.04E+01	8.44E+01	-4.828	

R: 227. X: 0. Y: 228. DL: 455. REQ: 253. CF: 1.0000
CLHZ ARRAY, 25 DATA POINTS, RAMP: 165.0 MICROSEC, DATA: PB8
0808 PB 800WZ OPR XTL H 3 8 +100
Ch.21 = 0.165 Ch.22 = 0.089 Ch.23 = 11 Ch.24 =
RMS LOG ERROR: 2.20E-02, ANTILOG YIELDS 5.1844 %
LATE TIME PARAMETERS

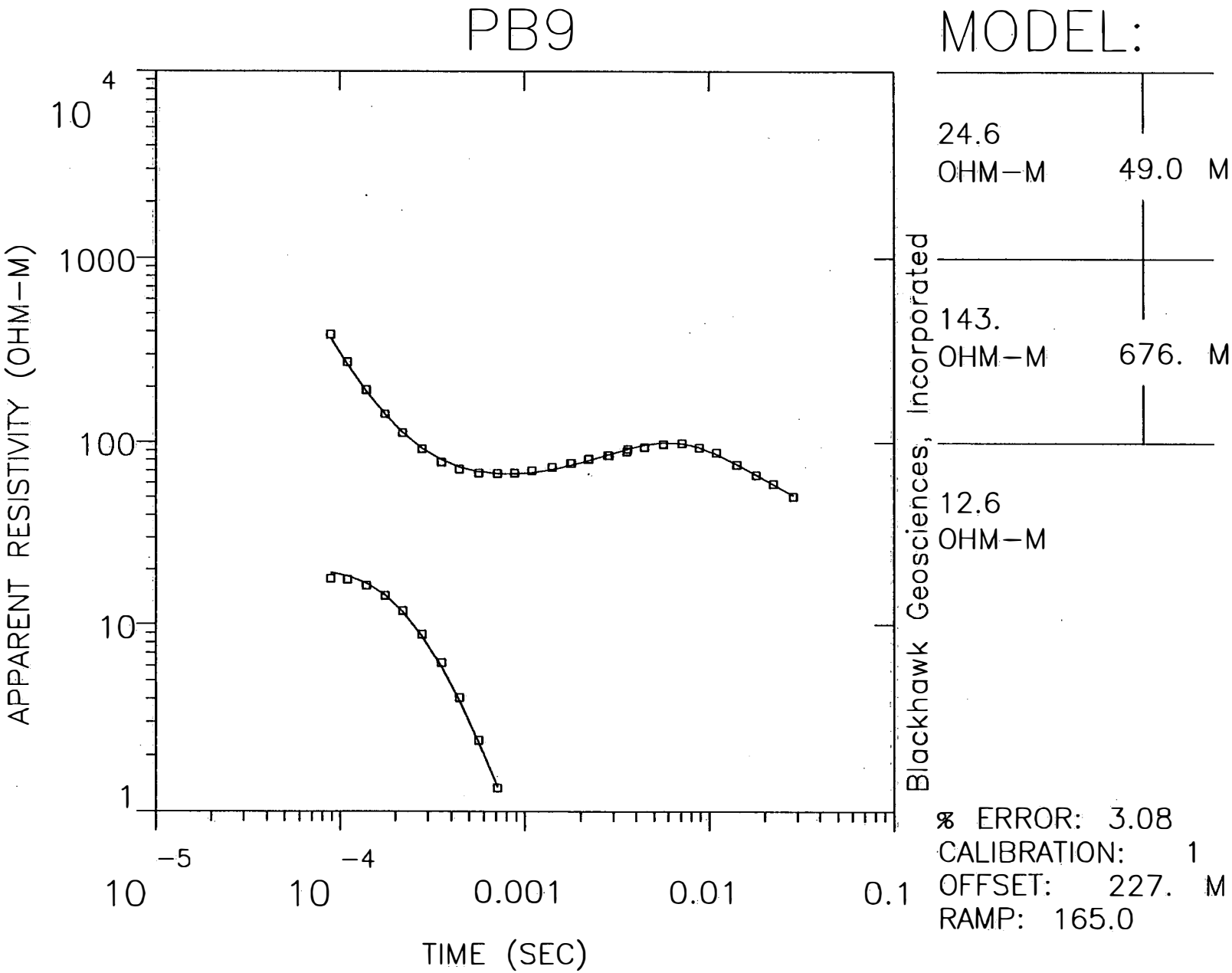
* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER
P 1 0.77
P 2 -0.04 0.98
P 3 -0.02 -0.03 0.89

```
T 1 -0.33 -0.08 -0.04  0.50
T 2  0.03  0.01  0.02  0.04  0.99
       P 1   P 2   P 3   T 1   T 2
```

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	21.445	37.401	61.509
	2	195.973	218.701	274.081
	3	16.640	23.334	33.894
THICK	1	9.720	21.757	46.146
	2	402.641	465.685	500.817
DEPTH	1	9.720	21.757	46.146
	2	448.787	487.442	515.756


PB9
MODEL:
APPARENT RESISTIVITY (OHM-M)
10 4
1000
100
10
1
10 -5
10 -4
0.001
0.01
0.1
TIME (SEC)
24.6
OHM-M
49.0 M
143.
OHM-M
676. M
12.6
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 3.08
CALIBRATION: 1
OFFSET: 227. M
RAMP: 165.0

PB9

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		341.1	1119.0		
24.63	49.0	292.1	958.4	2.0	2.0
142.73	676.3	-384.2	-1260.4	4.7	6.7
12.61					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	3.87E+02	3.68E+02	5.029	
2	1.10E-04	2.74E+02	2.66E+02	3.232	
3	1.40E-04	1.93E+02	1.89E+02	1.760	
4	1.77E-04	1.42E+02	1.42E+02	0.453	
5	2.20E-04	1.12E+02	1.13E+02	-0.832	
6	2.80E-04	9.16E+01	9.28E+01	-1.372	
7	3.55E-04	7.79E+01	8.04E+01	-3.025	
8	4.43E-04	7.15E+01	7.33E+01	-2.395	
9	5.64E-04	6.79E+01	6.89E+01	-1.500	
10	7.13E-04	6.77E+01	6.72E+01	0.742	
11	8.81E-04	6.80E+01	6.71E+01	1.352	
12	1.10E-03	6.99E+01	6.83E+01	2.327	
13	1.41E-03	7.30E+01	7.11E+01	2.651	
14	1.77E-03	7.66E+01	7.48E+01	2.445	
15	1.80E-03	7.69E+01	7.50E+01	2.450	
16	2.20E-03	8.05E+01	7.93E+01	1.529	
17	2.22E-03	8.14E+01	7.95E+01	2.324	
18	2.80E-03	8.49E+01	8.53E+01	-0.461	
19	2.85E-03	8.49E+01	8.57E+01	-0.942	
20	3.55E-03	8.91E+01	9.16E+01	-2.698	
21	3.60E-03	9.19E+01	9.20E+01	-0.034	
22	4.43E-03	9.42E+01	9.68E+01	-2.659	
23	5.64E-03	9.75E+01	9.99E+01	-2.388	
24	7.13E-03	9.91E+01	9.85E+01	0.598	
25	8.81E-03	9.38E+01	9.35E+01	0.234	
26	1.10E-02	8.78E+01	8.58E+01	2.250	
27	1.41E-02	7.55E+01	7.57E+01	-0.230	
28	1.80E-02	6.61E+01	6.64E+01	-0.346	
29	2.22E-02	5.94E+01	5.89E+01	0.822	
30	2.85E-02	5.05E+01	5.15E+01	-1.838	

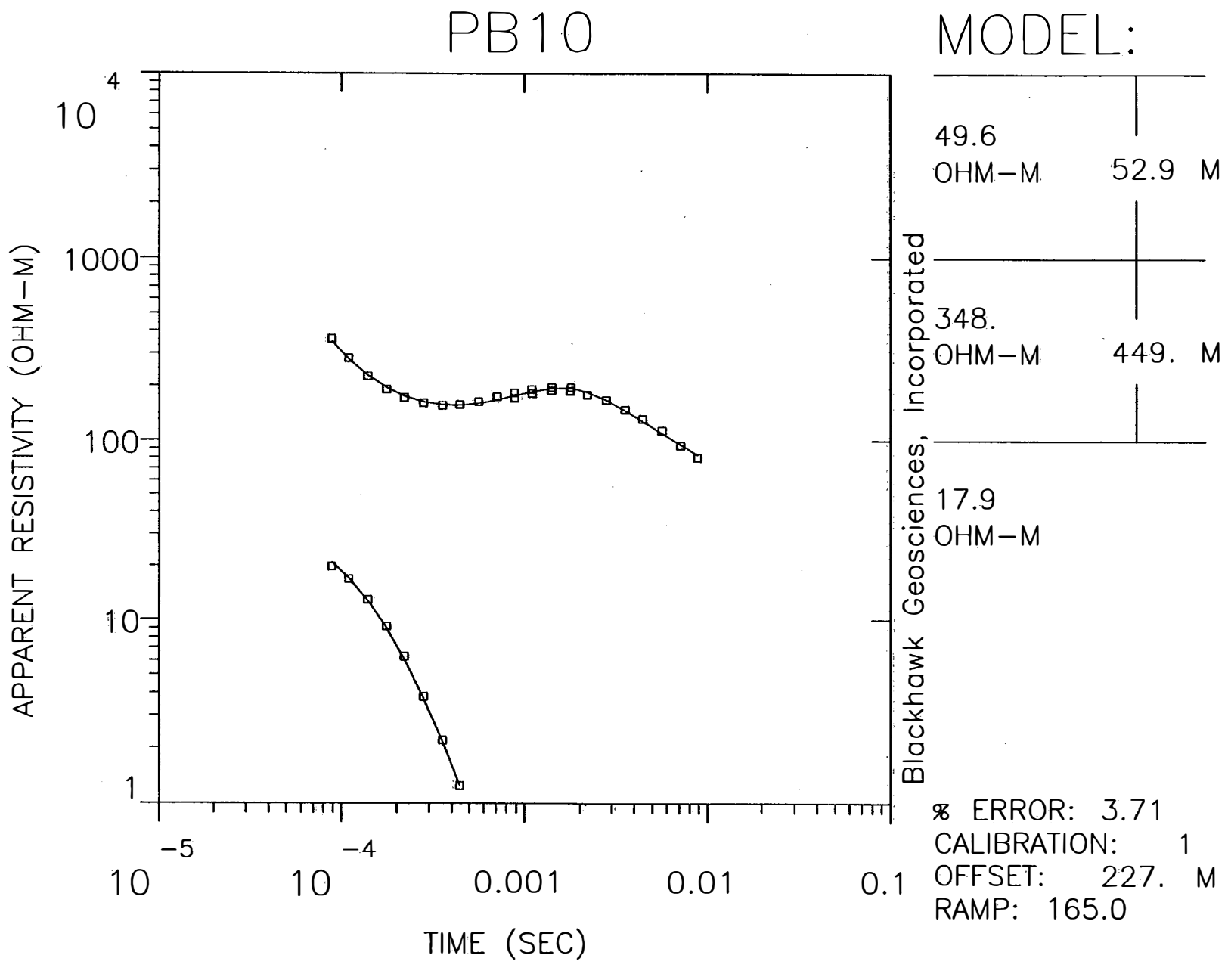
R: 227. X: 0. Y: 228. DL: 455. REQ: 253. CF: 1.0000
CLHZ ARRAY, 30 DATA POINTS, RAMP: 165.0 MICROSEC, DATA: PB9
0808 PB 900WZ OPR XTL L 6 8 +100
Ch.21 = 0.165 Ch.22 = 0.89 Ch.23 = 11 Ch.24 = 2
RMS LOG ERROR: 1.32E-02, ANTILOG YIELDS 3.0807 %
LATE TIME PARAMETERS

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.96				
P 2	-0.02	0.96			
P 3	-0.01	-0.04	0.78		
T 1	-0.06	-0.05	-0.03	0.89	
T 2	0.01	0.01	0.03	0.02	0.99
	P 1	P 2	P 3	T 1	T 2

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	20.550	24.631	28.670
	2	128.828	142.732	164.391
	3	9.303	12.609	17.088
THICK	1	36.916	48.950	63.301
	2	626.106	676.292	713.116
DEPTH	1	36.916	48.950	63.301
	2	682.807	725.242	757.361


PB10
MODEL:
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
49.6
OHM-M
52.9 M
348.
OHM-M
449. M
17.9
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 3.71
CALIBRATION: 1
OFFSET: 227. M
RAMP: 165.0

PB10

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		458.1	1503.0		
49.62	52.9	405.3	1329.6	1.1	1.1
347.97	449.3	-44.0	-144.5	1.3	2.4
17.87					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	3.62E+02	3.48E+02	3.783	
2	1.10E-04	2.82E+02	2.79E+02	0.971	
3	1.40E-04	2.25E+02	2.27E+02	-0.870	
4	1.77E-04	1.91E+02	1.95E+02	-1.746	
5	2.20E-04	1.71E+02	1.75E+02	-2.214	
6	2.80E-04	1.61E+02	1.63E+02	-1.241	
7	3.55E-04	1.55E+02	1.57E+02	-0.898	
8	4.43E-04	1.57E+02	1.56E+02	0.786	
9	5.64E-04	1.63E+02	1.60E+02	2.084	
10	7.13E-04	1.74E+02	1.67E+02	4.164	
11	8.81E-04	1.82E+02	1.76E+02	3.590	
12	8.90E-04	1.71E+02	1.77E+02	-3.321	
13	1.10E-03	1.91E+02	1.86E+02	2.696	
14	1.10E-03	1.81E+02	1.86E+02	-2.647	
15	1.40E-03	1.88E+02	1.94E+02	-2.748	
16	1.41E-03	1.96E+02	1.94E+02	0.955	
17	1.77E-03	1.88E+02	1.93E+02	-3.011	
18	1.80E-03	1.95E+02	1.93E+02	0.940	
19	2.20E-03	1.79E+02	1.84E+02	-3.115	
20	2.80E-03	1.67E+02	1.67E+02	-0.063	
21	3.55E-03	1.47E+02	1.46E+02	0.586	
22	4.43E-03	1.31E+02	1.28E+02	2.854	
23	5.64E-03	1.13E+02	1.09E+02	3.478	
24	7.13E-03	9.37E+01	9.43E+01	-0.662	
25	8.81E-03	8.01E+01	8.30E+01	-3.466	

R: 227. X: 0. Y: 228. DL: 455. REQ: 253. CF: 1.0000
CLHZ ARRAY, 25 DATA POINTS, RAMP: 165.0 MICROSEC, DATA: PB10
0908 PB 1000WZ OPR XTL H 3 8 +100
Ch.21 = 0.165 Ch.22 = 0.089 Ch.23 = 11 Ch.24 =
RMS LOG ERROR: 1.58E-02, ANTILOG YIELDS 3.7088 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

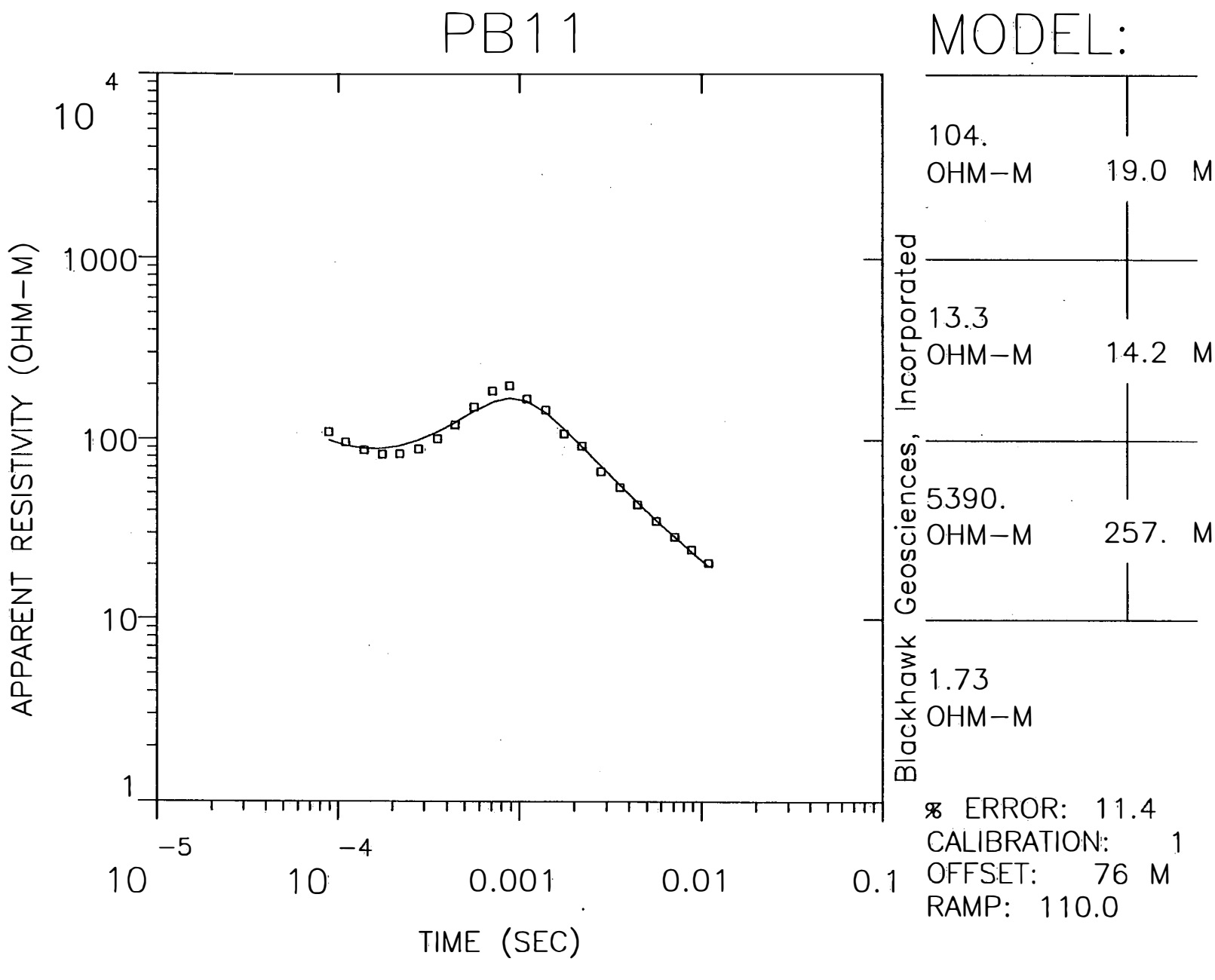
PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER
P 1 0.92
P 2 -0.10 0.71
P 3 0.00 -0.10 0.80

T 1	-0.14	-0.24	-0.03	0.72	
T 2	0.02	0.05	0.03	0.05	0.99

	P 1	P 2	P 3	T 1	T 2

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	41.871	49.624	61.432
	2	277.377	347.966	473.401
	3	12.906	17.866	24.011
THICK	1	38.994	52.854	77.455
	2	416.903	449.295	474.625
DEPTH	1	38.994	52.854	77.455
	2	485.688	502.149	521.387


PB11
MODEL:
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
104.
OHM-M
19.0 M
13.3
OHM-M
14.2 M
5390.
OHM-M
257. M
1.73
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 11.4
CALIBRATION: 1
OFFSET: 76 M
RAMP: 110.0

PB11

MODEL: 4 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	(FEET)	CONDUCTANCE (S) LAYER	TOTAL
		260.0	853.0		
104.21	19.0	240.9	790.5	0.2	0.2
13.29	14.2	226.8	744.1	1.1	1.2
5389.87	256.7	-29.9	-98.2	0.0	1.3
1.73					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	1.09E+02	9.83E+01	11.082	
2	1.10E-04	9.57E+01	9.21E+01	4.006	
3	1.40E-04	8.70E+01	8.86E+01	-1.826	
4	1.77E-04	8.24E+01	8.87E+01	-7.105	
5	2.20E-04	8.24E+01	9.17E+01	-10.065	
6	2.80E-04	8.82E+01	9.84E+01	-10.423	
7	3.55E-04	9.98E+01	1.09E+02	-8.527	
8	4.43E-04	1.20E+02	1.23E+02	-2.792	
9	5.64E-04	1.50E+02	1.42E+02	5.372	
10	7.13E-04	1.83E+02	1.60E+02	14.590	
11	8.81E-04	1.97E+02	1.68E+02	16.826	
12	1.10E-03	1.67E+02	1.62E+02	3.237	
13	1.40E-03	1.45E+02	1.40E+02	3.592	
14	1.77E-03	1.07E+02	1.13E+02	-5.663	
15	2.20E-03	9.19E+01	9.12E+01	0.693	
16	2.80E-03	6.64E+01	7.14E+01	-6.997	
17	3.55E-03	5.40E+01	5.61E+01	-3.686	
18	4.43E-03	4.33E+01	4.50E+01	-3.746	
19	5.64E-03	3.53E+01	3.56E+01	-0.860	
20	7.13E-03	2.88E+01	2.86E+01	0.669	
21	8.81E-03	2.44E+01	2.36E+01	3.317	
22	1.10E-02	2.06E+01	1.96E+01	5.112	

R: 76. X: 0. Y: 76. DL: 152. REQ: 84. CF: 1.0000
CLHZ ARRAY, 22 DATA POINTS, RAMP: 110.0 MICROSEC, DATA: PB11
0908 PB 1100WZ OPR XTL L 6 8 +100
Ch.21 = 0.11 Ch.22 = 0.89 Ch.23 = 18 Ch.24 = 23
RMS LOG ERROR: 4.68E-02, ANTILOG YIELDS 11.3731 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

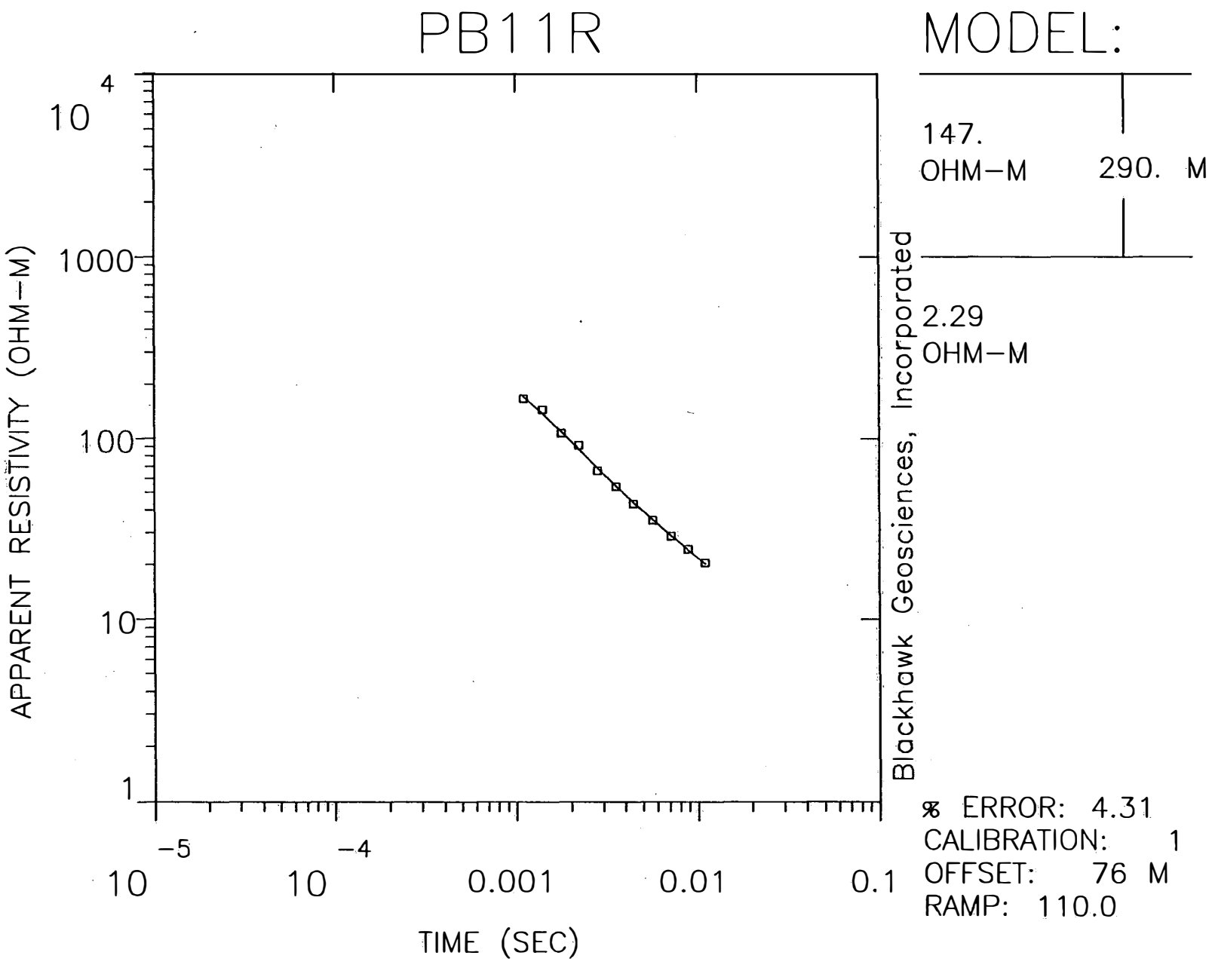
P 1	0.02				
P 2	0.09	0.53			
P 3	0.00	0.00	0.00		
P 4	0.00	0.01	0.00	0.08	
T 1	0.01	0.03	0.00	0.02	0.09

T 2	-0.07	-0.45	-0.01	0.04	0.05	0.46	
T 3	0.00	0.02	0.00	-0.02	0.06	0.01	0.95

	P 1	P 2	P 3	P 4	T 1	T 2	T 3

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	58.603	104.212	245.227
	2	6.383	13.289	21.345
	3	1704.426	5389.869	53898.687
	4	0.768	1.728	2.889
THICK	1	8.154	19.046	28.754
	2	6.996	14.160	25.130
	3	246.307	256.711	270.602
DEPTH	1	8.154	19.046	28.754
	2	22.925	33.206	43.286
	3	280.608	289.917	300.904


PB11R
MODEL:
147.
OHM-M
290. M
2.29
OHM-M
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
Blackhawk Geosciences, Incorporated
% ERROR: 4.31
CALIBRATION: 1
OFFSET: 76 M
RAMP: 110.0

PB11R

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		260.0	853.0		
146.95	289.7	-29.7	-97.5	2.0	2.0
2.29					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	1.10E-03	1.67E+02	1.71E+02	-2.481	
2	1.40E-03	1.45E+02	1.37E+02	5.450	
3	1.77E-03	1.07E+02	1.09E+02	-1.744	
4	2.20E-03	9.19E+01	8.76E+01	4.906	
5	2.80E-03	6.64E+01	6.89E+01	-3.729	
6	3.55E-03	5.40E+01	5.47E+01	-1.345	
7	4.43E-03	4.33E+01	4.44E+01	-2.401	
8	5.64E-03	3.53E+01	3.55E+01	-0.646	
9	7.13E-03	2.88E+01	2.89E+01	-0.331	
10	8.81E-03	2.44E+01	2.41E+01	1.090	
11	1.10E-02	2.06E+01	2.02E+01	1.649	

R: 76. X: 0. Y: 76. DL: 152. REQ: 84. CF: 1.0000
CLHZ ARRAY, 11 DATA POINTS, RAMP: 110.0 MICROSEC, DATA: PB11R
0908 PB 1100WZ OPR XTL L 6 8 +100
Ch.21 = 0.11 Ch.22 = 0.89 Ch.23 = 18 Ch.24 = 23
RMS LOG ERROR: 1.83E-02, ANTILOG YIELDS 4.3105 %
LATE TIME PARAMETERS

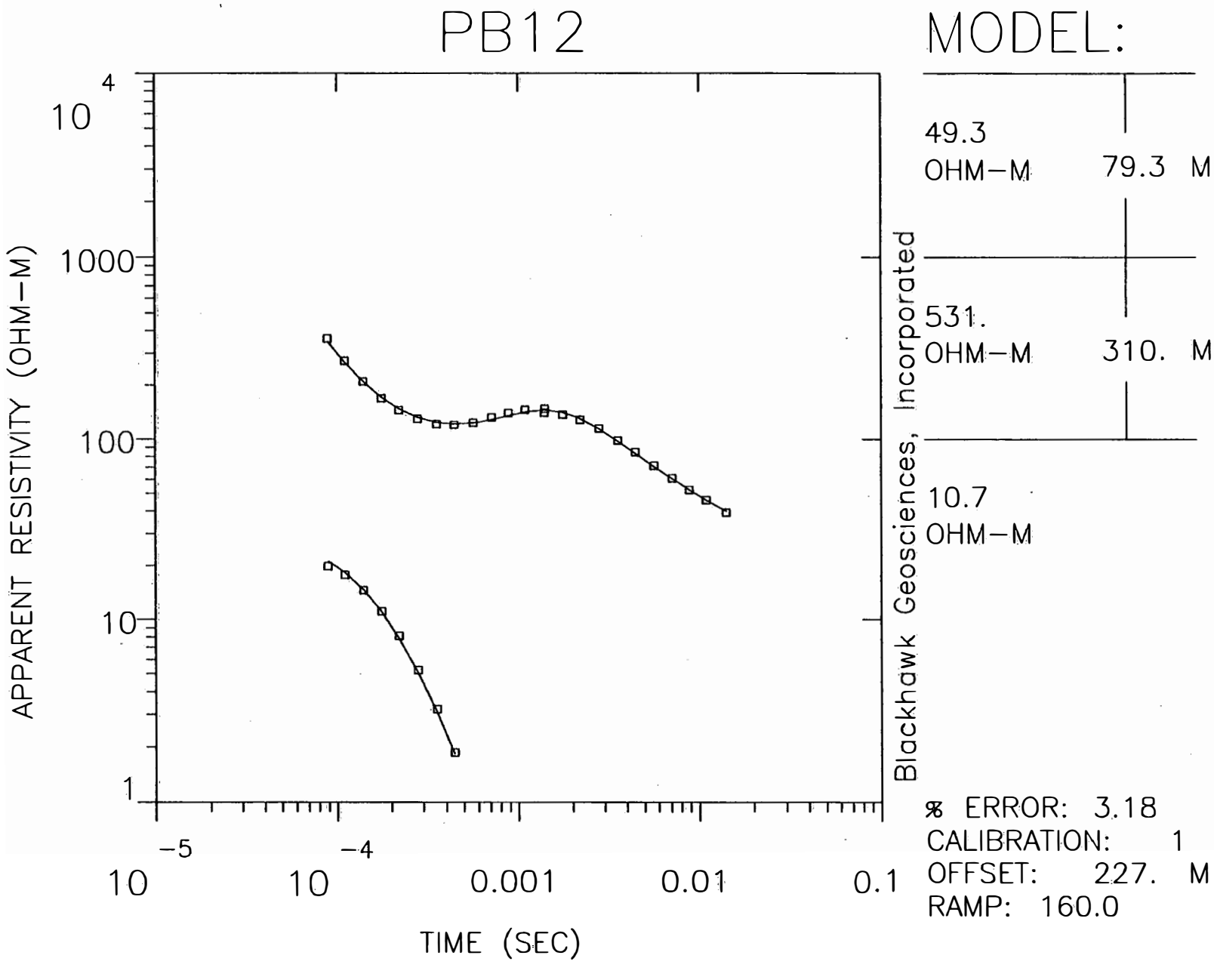
* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.99		
P 2	0.00	0.99	
T 1	0.00	0.00	1.00
	P 1	P 2	T 1

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	119.872	146.952	211.611
	2	1.806	2.286	2.944
THICK	1	283.799	289.720	294.351
DEPTH	1	283.799	289.720	294.351


PB12
MODEL:
APPARENT RESISTIVITY (OHM-M)
10 4
1000
100
10
1
10 -5
10 -4
0.001
0.01
0.1
TIME (SEC)
49.3
OHM-M
79.3 M
531.
OHM-M
310. M
10.7
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 3.18
CALIBRATION: 1
OFFSET: 227. M
RAMP: 160.0

PB12

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		417.9	1371.0		
49.35	79.3	338.5	1110.7	1.6	1.6
530.76	309.8	28.7	94.2	0.6	2.2
10.66					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	3.62E+02	3.46E+02	4.559	
2	1.10E-04	2.73E+02	2.67E+02	1.974	
3	1.40E-04	2.08E+02	2.08E+02	0.329	
4	1.77E-04	1.69E+02	1.70E+02	-1.012	
5	2.20E-04	1.45E+02	1.48E+02	-2.117	
6	2.80E-04	1.29E+02	1.32E+02	-2.024	
7	3.55E-04	1.21E+02	1.24E+02	-2.446	
8	4.43E-04	1.20E+02	1.21E+02	-1.138	
9	5.64E-04	1.23E+02	1.23E+02	0.310	
10	7.13E-04	1.32E+02	1.28E+02	3.201	
11	8.81E-04	1.39E+02	1.35E+02	3.347	
12	1.10E-03	1.45E+02	1.41E+02	2.783	
13	1.40E-03	1.40E+02	1.45E+02	-3.272	
14	1.41E-03	1.47E+02	1.45E+02	1.374	
15	1.77E-03	1.36E+02	1.41E+02	-3.146	
16	2.20E-03	1.28E+02	1.30E+02	-1.971	
17	2.80E-03	1.14E+02	1.14E+02	0.288	
18	3.55E-03	9.82E+01	9.75E+01	0.759	
19	4.43E-03	8.49E+01	8.35E+01	1.626	
20	5.64E-03	7.14E+01	7.06E+01	1.181	
21	7.13E-03	6.09E+01	6.03E+01	0.984	
22	8.81E-03	5.25E+01	5.26E+01	-0.215	
23	1.10E-02	4.60E+01	4.61E+01	-0.154	
24	1.41E-02	3.93E+01	3.99E+01	-1.498	

R: 227. X: 0. Y: 228. DL: 455. REQ: 253. CF: 1.0000
CLHZ ARRAY, 24 DATA POINTS, RAMP: 160.0 MICROSEC, DATA: PB12
1008 PB 1200WZ OPR XTL L 5 8 +100
Ch.21 = 0.16 Ch.22 = 0.89 Ch.23 = 11 Ch.24 = 20
RMS LOG ERROR: 1.36E-02, ANTILOG YIELDS 3.1795 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

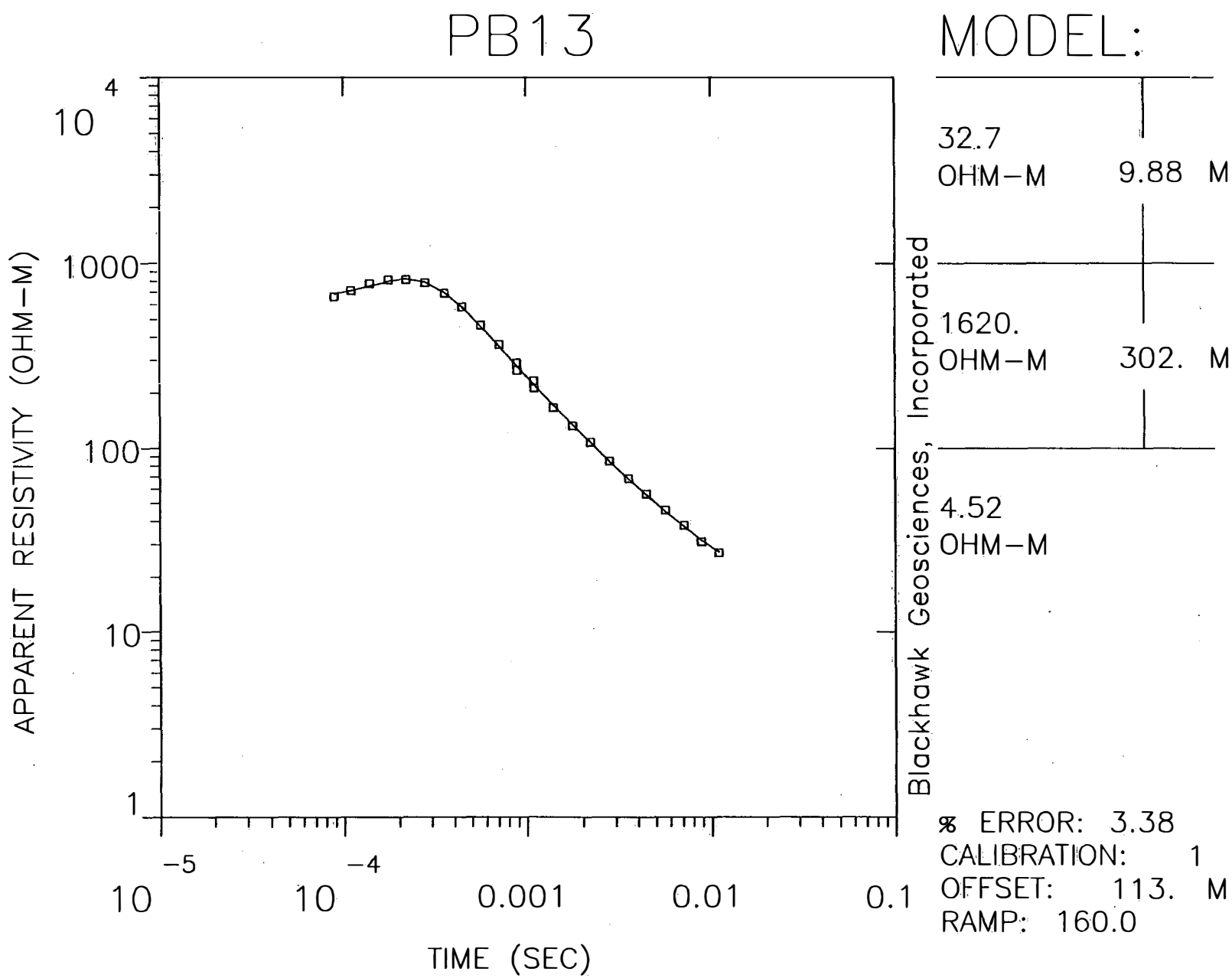
PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.98			
P 2	-0.03	0.09		
P 3	0.01	-0.04	0.92	
T 1	-0.03	-0.15	0.02	0.93

T 2 0.00 0.06 0.01 0.01 0.99
P 1 P 2 P 3 T 1 T 2

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	43.650	49.349	54.059
	2	324.955	530.759	940.683
	3	9.228	10.663	12.612
THICK	1	64.701	79.344	93.352
	2	292.380	309.829	328.408
DEPTH	1	64.701	79.344	93.352
	2	379.985	389.173	399.472


PB13
MODEL:
APPARENT RESISTIVITY (OHM-M)
10 4
1000
100
10
1
10 -5
10 -4
0.001
0.01
0.1
TIME (SEC)
32.7
OHM-M
9.88 M
1620.
OHM-M
302. M
4.52
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 3.38
CALIBRATION: 1
OFFSET: 113. M
RAMP: 160.0

PB13

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	(FEET)	CONDUCTANCE (S) LAYER	TOTAL
		289.0	948.0		
32.73	9.9	279.1	915.6	0.3	0.3
1620.43	301.7	-22.7	-74.3	0.2	0.5
4.52					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	6.64E+02	6.84E+02	-2.953	
2	1.10E-04	7.14E+02	7.13E+02	0.036	
3	1.40E-04	7.79E+02	7.58E+02	2.665	
4	1.77E-04	8.16E+02	8.03E+02	1.541	
5	2.20E-04	8.20E+02	8.24E+02	-0.531	
6	2.80E-04	7.86E+02	7.94E+02	-1.050	
7	3.55E-04	6.91E+02	7.01E+02	-1.436	
8	4.43E-04	5.83E+02	5.83E+02	-0.041	
9	5.64E-04	4.64E+02	4.57E+02	1.457	
10	7.13E-04	3.65E+02	3.55E+02	2.812	
11	8.81E-04	2.91E+02	2.82E+02	3.387	
12	8.90E-04	2.66E+02	2.78E+02	-4.556	
13	1.10E-03	2.32E+02	2.22E+02	4.453	
14	1.10E-03	2.13E+02	2.21E+02	-3.581	
15	1.40E-03	1.67E+02	1.71E+02	-2.724	
16	1.77E-03	1.32E+02	1.34E+02	-1.439	
17	2.20E-03	1.07E+02	1.08E+02	-0.259	
18	2.80E-03	8.53E+01	8.52E+01	0.168	
19	3.55E-03	6.85E+01	6.82E+01	0.510	
20	4.43E-03	5.66E+01	5.59E+01	1.279	
21	5.64E-03	4.61E+01	4.54E+01	1.588	
22	7.13E-03	3.81E+01	3.75E+01	1.483	
23	8.81E-03	3.12E+01	3.19E+01	-2.131	
24	1.10E-02	2.70E+01	2.72E+01	-0.637	

R: 113. X: 0. Y: 114. DL: 227. REQ: 127. CF: 1.0000
CLHZ ARRAY, 24 DATA POINTS, RAMP: 160.0 MICROSEC, DATA: PB13
1008 PB 1300WZ OPR XTL H 4 8 +100
Ch.21 = 0.14 Ch.22 = 0.089 Ch.23 = 17 Ch.24 = 5
RMS LOG ERROR: 1.44E-02, ANTILOG YIELDS 3.3824 %
LATE TIME PARAMETERS

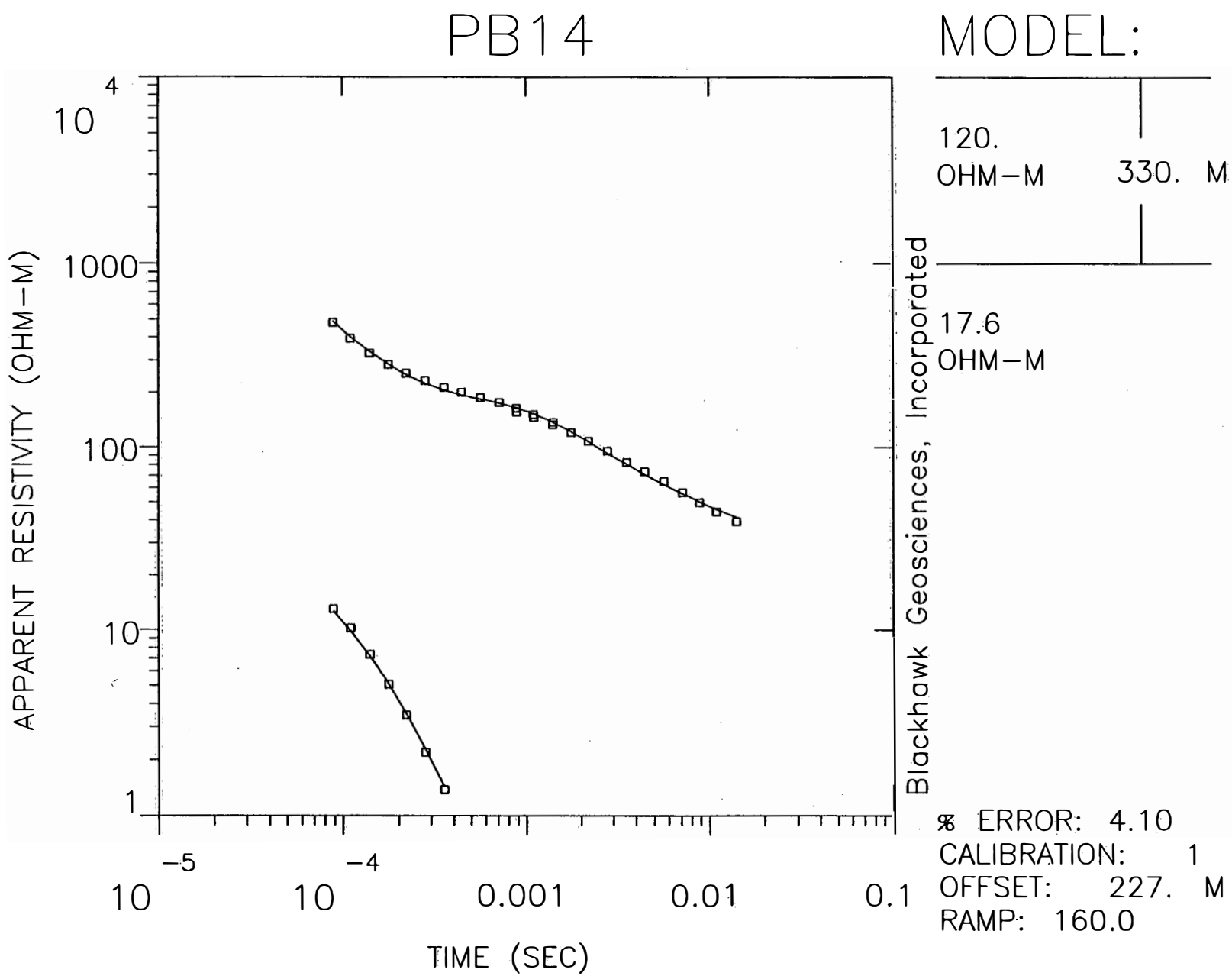
* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER
P 1 0.66
P 2 -0.04 0.12
P 3 0.04 -0.04 0.91
T 1 -0.34 -0.19 0.04 0.62

T 2 0.01 0.01 0.00 0.01 1.00
P 1 P 2 P 3 T 1 T 2

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	22.187	32.727	45.363
	2	1158.703	1620.427	2670.875
	3	4.031	4.521	5.071
THICK	1	6.647	9.875	14.148
	2	296.672	301.725	305.837
DEPTH	1	6.647	9.875	14.148
	2	308.517	311.600	314.372


PB14
MODEL:
120.
OHM-M
330. M
17.6
OHM-M
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
Blackhawk Geosciences, Incorporated
% ERROR: 4.10
CALIBRATION: 1
OFFSET: 227. M
RAMP: 160.0

PB14

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		319.1	1047.0		
119.81	329.8	-10.6	-34.9	2.8	2.8
17.57					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	4.78E+02	4.87E+02	-1.844	
2	1.10E-04	3.94E+02	4.03E+02	-2.365	
3	1.40E-04	3.28E+02	3.33E+02	-1.593	
4	1.77E-04	2.84E+02	2.85E+02	-0.030	
5	2.20E-04	2.55E+02	2.51E+02	1.319	
6	2.80E-04	2.32E+02	2.25E+02	3.170	
7	3.55E-04	2.13E+02	2.06E+02	3.044	
8	4.43E-04	2.00E+02	1.94E+02	3.198	
9	5.64E-04	1.87E+02	1.84E+02	1.922	
10	7.13E-04	1.76E+02	1.74E+02	1.114	
11	8.81E-04	1.64E+02	1.65E+02	-0.711	
12	8.90E-04	1.56E+02	1.64E+02	-5.105	
13	1.10E-03	1.51E+02	1.53E+02	-1.109	
14	1.10E-03	1.45E+02	1.52E+02	-4.789	
15	1.40E-03	1.32E+02	1.37E+02	-3.340	
16	1.41E-03	1.37E+02	1.36E+02	0.054	
17	1.77E-03	1.20E+02	1.21E+02	-1.002	
18	2.20E-03	1.08E+02	1.07E+02	0.587	
19	2.80E-03	9.50E+01	9.29E+01	2.345	
20	3.55E-03	8.29E+01	8.08E+01	2.536	
21	4.43E-03	7.37E+01	7.13E+01	3.356	
22	5.64E-03	6.52E+01	6.26E+01	4.085	
23	7.13E-03	5.66E+01	5.56E+01	1.780	
24	8.81E-03	5.00E+01	5.03E+01	-0.725	
25	1.10E-02	4.45E+01	4.57E+01	-2.612	
26	1.41E-02	3.93E+01	4.13E+01	-4.798	

R: 227. X: 0. Y: 228. DL: 455. REQ: 253. CF: 1.0000
CLHZ ARRAY, 26 DATA POINTS, RAMP: 160.0 MICROSEC, DATA: PB14
1008 PB 1400WZ OPR XTL H 3 8 +100
Ch.21 = 0.16 Ch.22 = 0.089 Ch.23 = 11 Ch.24 = 2
RMS LOG ERROR: 1.74E-02, ANTILOG YIELDS 4.0998 %
LATE TIME PARAMETERS

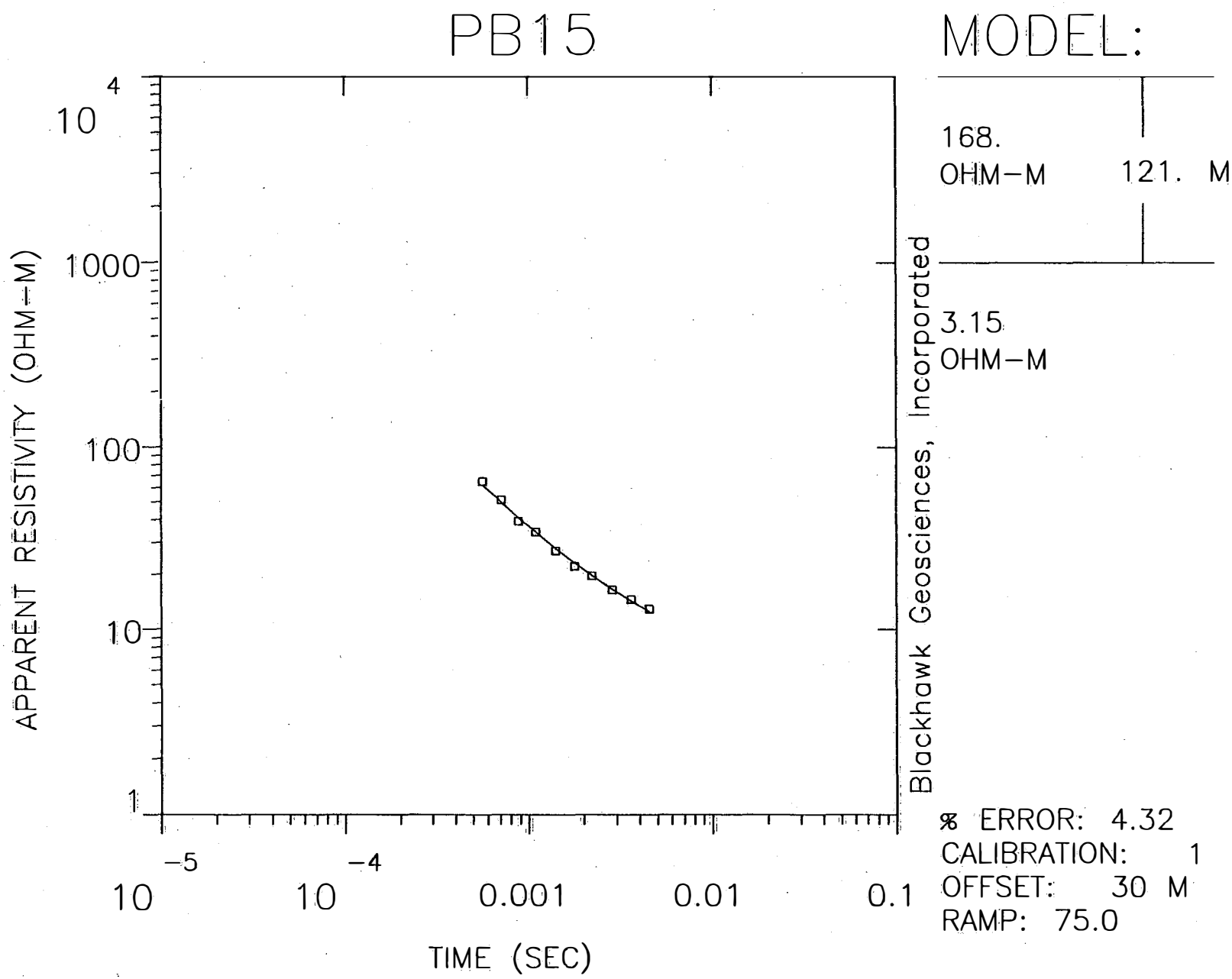
* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER
P 1 1.00
P 2 0.00 1.00
T 1 0.00 0.00 1.00

P 1 P 2 T 1

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	116.198	119.806	123.773
	2	15.328	17.567	20.312
THICK	1	313.491	329.774	342.895
DEPTH	1	313.491	329.774	342.895


PB15
MODEL:
168.
OHM-M
121. M
3.15
OHM-M
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
Blackhawk Geosciences, Incorporated
% ERROR: 4.32
CALIBRATION: 1
OFFSET: 30 M
RAMP: 75.0

PB15

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		109.7	360.0		
167.60	121.0	-11.3	-37.1	0.7	0.7
3.15					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	5.64E-04	6.51E+01	6.23E+01	4.540	
2	7.13E-04	5.14E+01	4.99E+01	3.021	
3	8.81E-04	3.94E+01	4.12E+01	-4.266	
4	1.10E-03	3.43E+01	3.42E+01	0.093	
5	1.41E-03	2.70E+01	2.77E+01	-2.712	
6	1.80E-03	2.23E+01	2.31E+01	-3.410	
7	2.22E-03	1.96E+01	1.97E+01	-0.533	
8	2.85E-03	1.65E+01	1.66E+01	-0.678	
9	3.60E-03	1.45E+01	1.43E+01	1.326	
10	4.49E-03	1.29E+01	1.25E+01	3.190	

R: 30. X: 0. Y: 30. DL: 60. REQ: 33. CF: 1.0000
CLHZ ARRAY, 10 DATA POINTS, RAMP: 75.0 MICROSEC, DATA: PB15
1108 PB 1500WZ OPR XTL H 4 8 +100
Ch.21 = 0.075 Ch.22 = 0.089 Ch.23 = 25 Ch.24 =
RMS LOG ERROR: 1.84E-02, ANTILOG YIELDS 4.3209 %
LATE TIME PARAMETERS

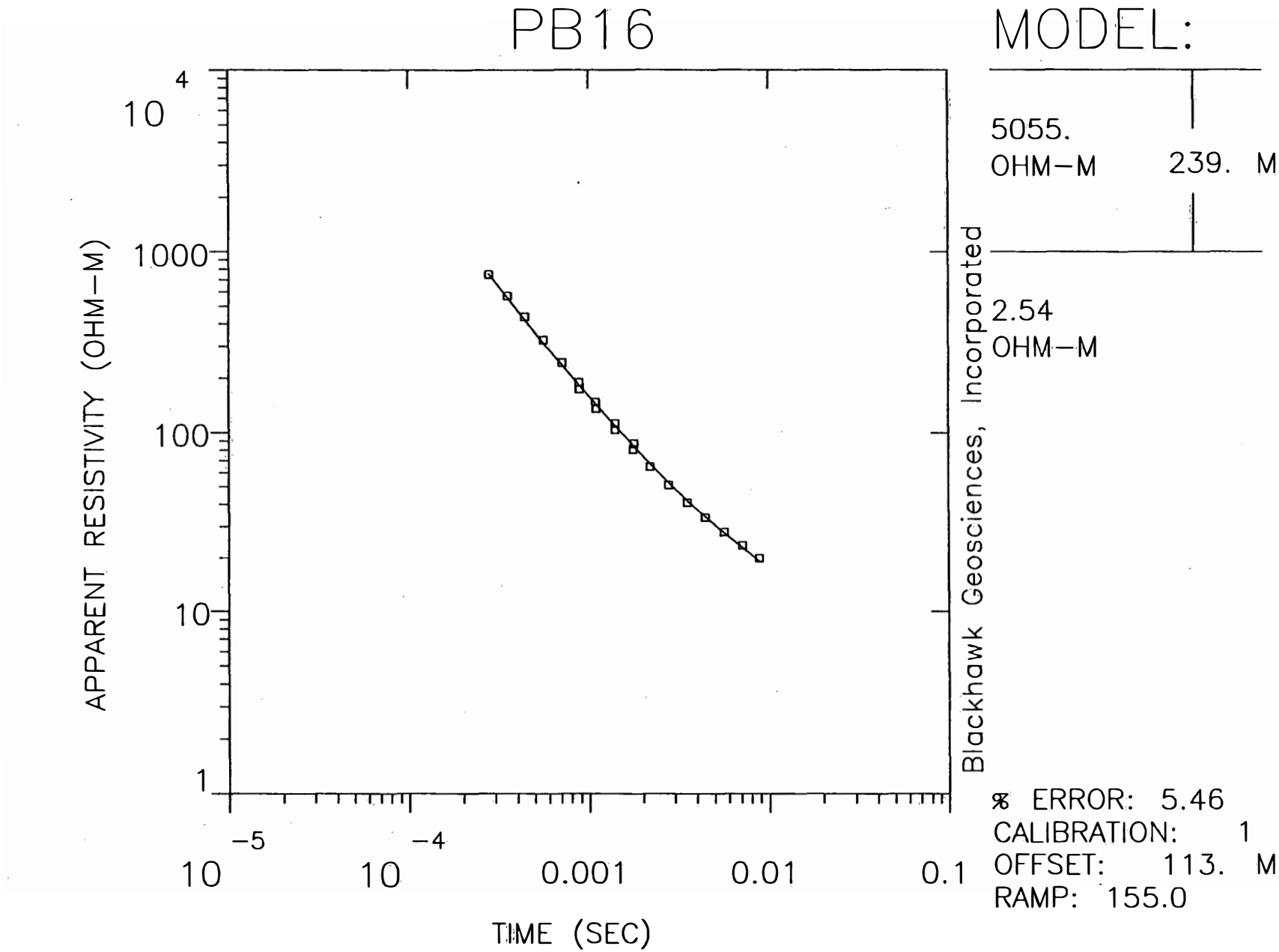
* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	T 1
P 1	0.19		
P 2	-0.05	0.95	
T 1	0.03	0.01	1.00

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	97.320	167.602	590.948
	2	2.787	3.152	3.549
THICK	1	115.401	121.024	125.525
DEPTH	1	115.401	121.024	125.525


PB16
MODEL:
5055.
OHM-M
239. M
2.54
OHM-M
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
Blackhawk Geosciences, Incorporated
% ERROR: 5.46
CALIBRATION: 1
OFFSET: 113. M
RAMP: 155.0

PB16

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		214.0	702.0		
5054.61	239.4	-25.4	-83.4	0.0	0.0
2.54					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	2.80E-04	7.44E+02	7.53E+02	-1.226	
2	3.55E-04	5.71E+02	5.56E+02	2.622	
3	4.43E-04	4.38E+02	4.21E+02	3.980	
4	5.64E-04	3.24E+02	3.13E+02	3.597	
5	7.13E-04	2.44E+02	2.36E+02	3.377	
6	8.81E-04	1.89E+02	1.84E+02	2.704	
7	8.90E-04	1.74E+02	1.82E+02	-4.541	
8	1.10E-03	1.48E+02	1.44E+02	2.889	
9	1.10E-03	1.36E+02	1.43E+02	-4.984	
10	1.40E-03	1.04E+02	1.09E+02	-5.171	
11	1.41E-03	1.12E+02	1.08E+02	3.584	
12	1.77E-03	8.09E+01	8.47E+01	-4.586	
13	1.80E-03	8.68E+01	8.35E+01	3.935	
14	2.20E-03	6.47E+01	6.75E+01	-4.093	
15	2.80E-03	5.12E+01	5.29E+01	-3.071	
16	3.55E-03	4.08E+01	4.20E+01	-2.784	
17	4.43E-03	3.36E+01	3.42E+01	-1.616	
18	5.64E-03	2.79E+01	2.76E+01	0.930	
19	7.13E-03	2.34E+01	2.27E+01	3.369	
20	8.81E-03	1.99E+01	1.92E+01	3.793	

R: 113. X: 0. Y: 114. DL: 227. REQ: 127. CF: 1.0000
CLHZ ARRAY, 20 DATA POINTS, RAMP: 155.0 MICROSEC, DATA: PB16
1108 PB 1600WZ OPR XTL L 4 8 +100
Ch.21 = 0.14 Ch.22 = 0.89 Ch.23 = 18 Ch.24 = 51
RMS LOG ERROR: 2.31E-02, ANTILOG YIELDS 5.4573 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

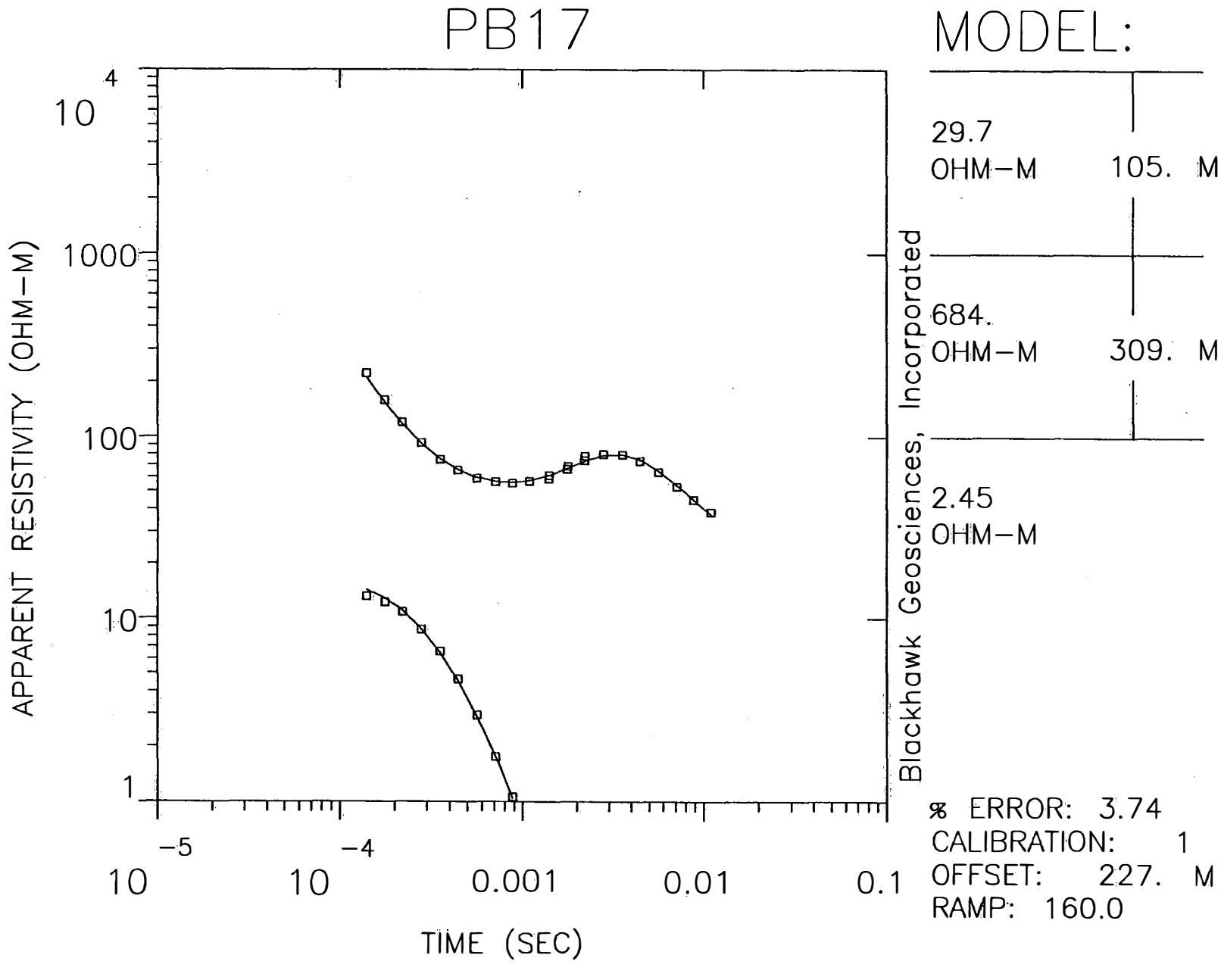
PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	T 1
P 1	0.08		
P 2	-0.02	1.00	
T 1	0.00	0.00	1.00

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	577.017	5054.612	30105.744
	2	2.120	2.544	3.053

THICK	1	236.174	239.393	243.366
DEPTH	1	236.174	239.393	243.366


PB17
MODEL:
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
29.7
OHM-M
105. M
684.
OHM-M
309. M
2.45
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 3.74
CALIBRATION: 1
OFFSET: 227. M
RAMP: 160.0

PB17

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		351.1	1152.0		
29.71	105.0	246.1	807.5	3.5	3.5
684.20	309.0	-62.9	-206.3	0.5	4.0
2.45					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	1.40E-04	2.23E+02	2.11E+02	5.628	
2	1.77E-04	1.58E+02	1.53E+02	3.176	
3	2.20E-04	1.20E+02	1.18E+02	1.369	
4	2.80E-04	9.26E+01	9.21E+01	0.557	
5	3.55E-04	7.49E+01	7.57E+01	-1.052	
6	4.43E-04	6.54E+01	6.60E+01	-0.943	
7	5.64E-04	5.90E+01	5.97E+01	-1.016	
8	7.13E-04	5.65E+01	5.67E+01	-0.325	
9	8.81E-04	5.55E+01	5.61E+01	-1.063	
10	1.10E-03	5.69E+01	5.75E+01	-1.087	
11	1.40E-03	5.88E+01	6.14E+01	-4.242	
12	1.41E-03	6.13E+01	6.15E+01	-0.413	
13	1.77E-03	6.64E+01	6.70E+01	-1.023	
14	1.80E-03	6.89E+01	6.74E+01	2.136	
15	2.20E-03	7.42E+01	7.33E+01	1.231	
16	2.22E-03	7.84E+01	7.36E+01	6.546	
17	2.80E-03	8.03E+01	7.91E+01	1.484	
18	3.55E-03	7.98E+01	8.00E+01	-0.312	
19	4.43E-03	7.35E+01	7.50E+01	-1.914	
20	5.64E-03	6.39E+01	6.49E+01	-1.546	
21	7.13E-03	5.33E+01	5.40E+01	-1.306	
22	8.81E-03	4.49E+01	4.50E+01	-0.235	
23	1.10E-02	3.87E+01	3.72E+01	3.860	

R: 227. X: 0. Y: 228. DL: 455. REQ: 253. CF: 1.0000
CLHZ ARRAY, 23 DATA POINTS, RAMP: 160.0 MICROSEC, DATA: PB17
1108 PB 1700WZ OPR XTL L 4 8 +100
Ch.21 = 0.16 Ch.22 = 0.89 Ch.23 = 11 Ch.24 = 20
RMS LOG ERROR: 1.60E-02, ANTILOG YIELDS 3.7447 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

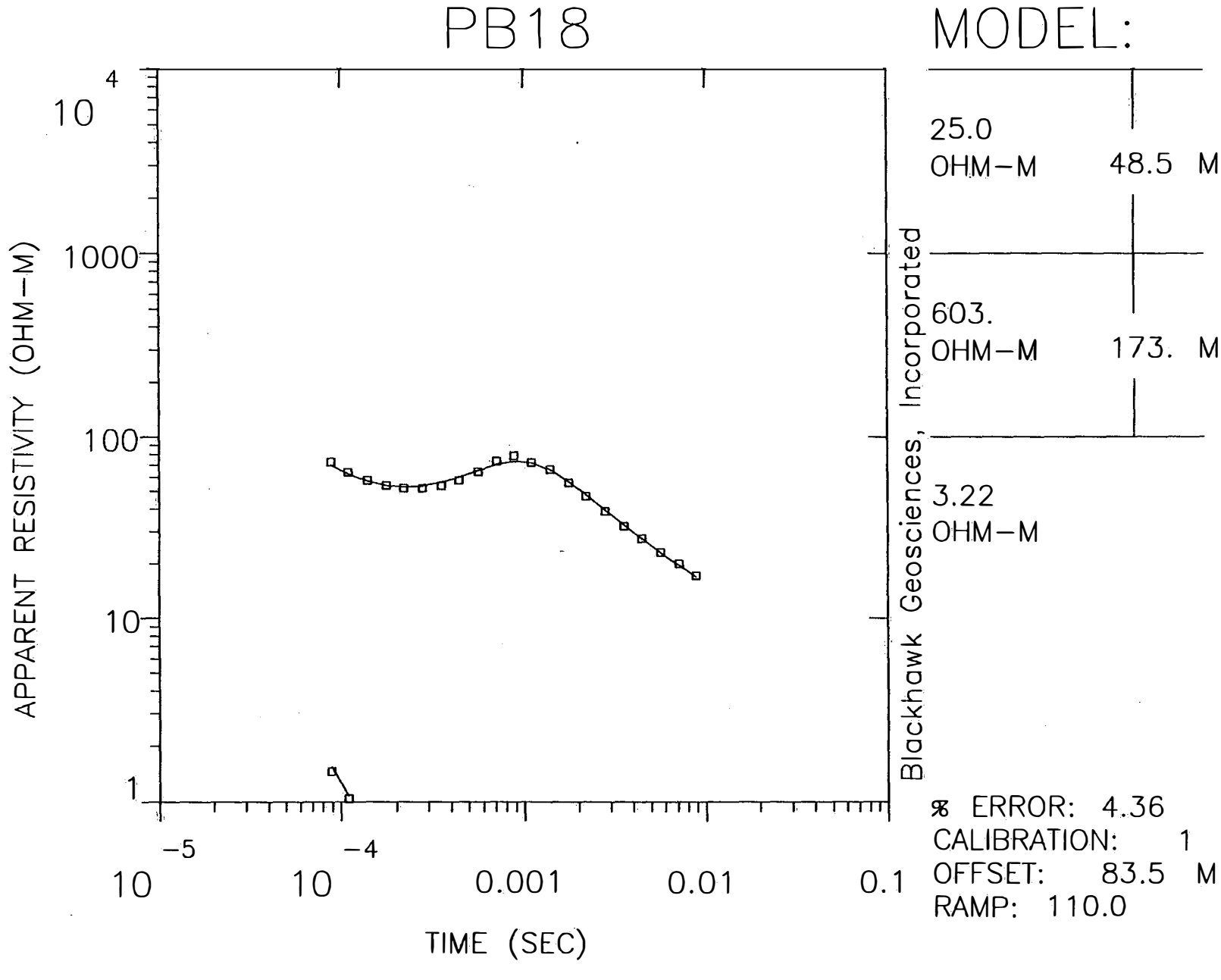
PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.99				
P 2	0.00	0.01			
P 3	0.02	-0.03	0.46		
T 1	-0.02	-0.04	0.05	0.97	
T 2	0.00	0.02	-0.03	0.01	0.99

P 1 P 2 P 3 T 1 T 2

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	27.438	29.705	31.859
	2	311.527	684.203	2731.000
	3	1.477	2.447	4.084
THICK	1	92.380	105.014	118.306
	2	287.371	308.994	325.033
DEPTH	1	92.380	105.014	118.306
	2	404.812	414.008	422.167


PB18
MODEL:
APPARENT RESISTIVITY (OHM-M)
10 4
1000
100
10
1
10 -5
10 -4
0.001
0.01
0.1
TIME (SEC)
25.0
OHM-M
48.5 M
603.
OHM-M
173. M
3.22
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 4.36
CALIBRATION: 1
OFFSET: 83.5 M
RAMP: 110.0

PB18

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		168.9	554.0		
25.01	48.5	120.4	394.9	1.9	1.9
603.06	173.1	-52.8	-173.1	0.3	2.2
3.22					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	7.27E+01	6.99E+01	4.038	
2	1.10E-04	6.39E+01	6.24E+01	2.355	
3	1.40E-04	5.77E+01	5.69E+01	1.471	
4	1.77E-04	5.41E+01	5.39E+01	0.311	
5	2.20E-04	5.22E+01	5.29E+01	-1.358	
6	2.80E-04	5.22E+01	5.37E+01	-2.700	
7	3.55E-04	5.37E+01	5.62E+01	-4.521	
8	4.43E-04	5.76E+01	6.00E+01	-3.995	
9	5.64E-04	6.42E+01	6.54E+01	-1.814	
10	7.13E-04	7.37E+01	7.06E+01	4.361	
11	8.81E-04	7.89E+01	7.32E+01	7.769	
12	1.10E-03	7.24E+01	7.19E+01	0.648	
13	1.40E-03	6.58E+01	6.55E+01	0.449	
14	1.77E-03	5.59E+01	5.65E+01	-1.021	
15	2.20E-03	4.69E+01	4.79E+01	-2.175	
16	2.80E-03	3.87E+01	3.95E+01	-1.927	
17	3.55E-03	3.20E+01	3.27E+01	-1.945	
18	4.43E-03	2.73E+01	2.75E+01	-0.527	
19	5.64E-03	2.30E+01	2.29E+01	0.450	
20	7.13E-03	1.99E+01	1.94E+01	2.234	
21	8.81E-03	1.71E+01	1.69E+01	1.513	

R: 83. X: 0. Y: 84. DL: 167. REQ: 93. CF: 1.0000
CLHZ ARRAY, 21 DATA POINTS, RAMP: 110.0 MICROSEC, DATA: PB18
1208 PB 1800WZ OPR XTL L 5 8 +100
Ch.21 = 0.11 Ch.22 = 0.89 Ch.23 = 18.5 Ch.24 =
RMS LOG ERROR: 1.85E-02, ANTILOG YIELDS 4.3606 %
LATE TIME PARAMETERS

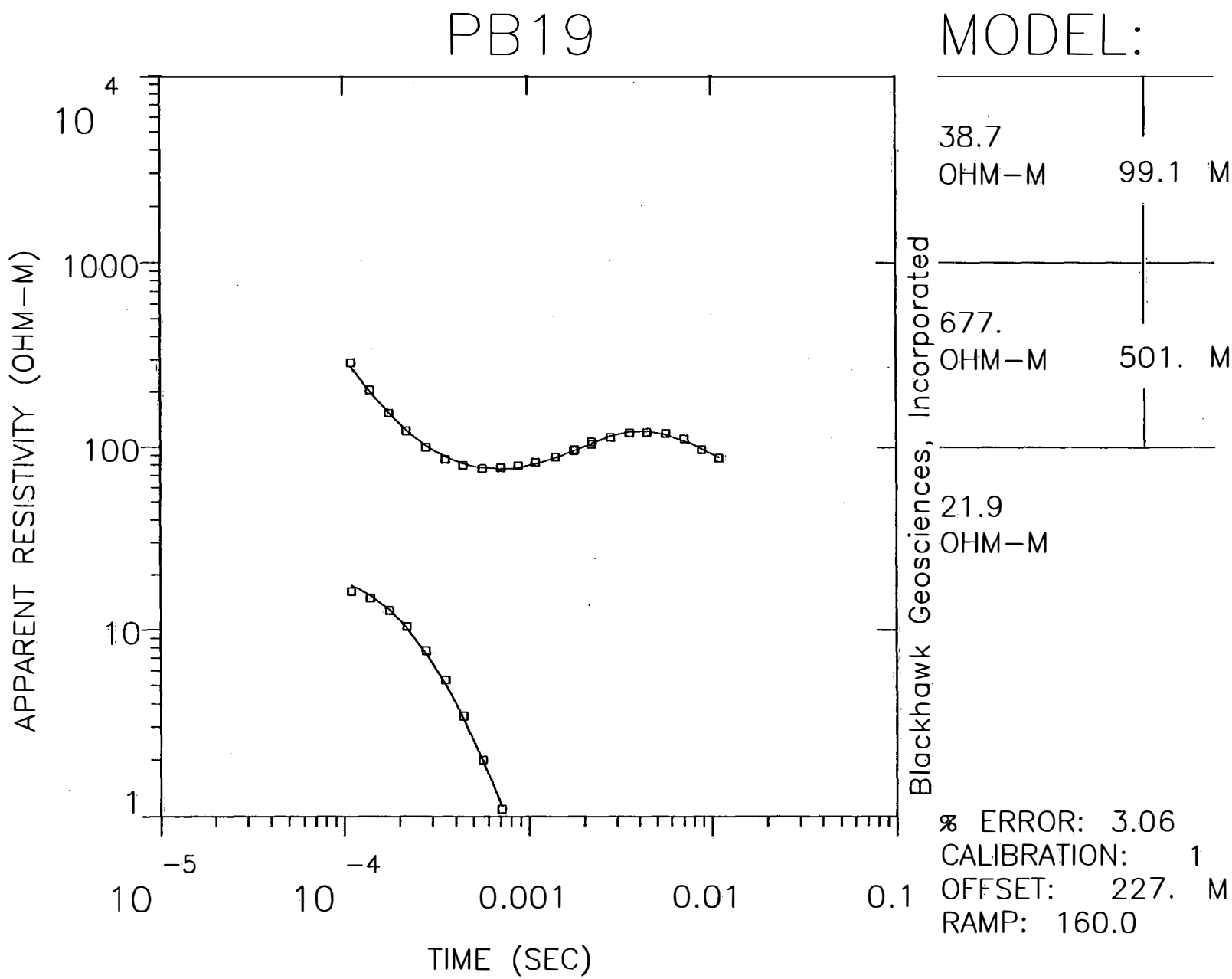
* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2
P 1	0.98				
P 2	-0.01	0.01			
P 3	0.02	-0.01	0.87		
T 1	-0.03	-0.06	0.03	0.95	
T 2	0.00	0.02	0.00	0.01	1.00

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	22.835	25.014	27.950
	2	274.582	603.062	2572.424
	3	2.501	3.217	3.937
THICK	1	42.078	48.487	57.824
	2	162.783	173.130	181.045
DEPTH	1	42.078	48.487	57.824
	2	218.256	221.618	226.028


PB19
MODEL:
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
38.7
OHM-M
99.1 M
677.
OHM-M
501. M
21.9
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 3.06
CALIBRATION: 1
OFFSET: 227. M
RAMP: 160.0

PB19

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		399.0	1309.0		
38.65	99.1	299.9	983.8	2.6	2.6
677.27	500.7	-200.8	-658.8	0.7	3.3
21.92					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	1.10E-04	2.89E+02	2.75E+02	4.992	
2	1.40E-04	2.05E+02	2.01E+02	2.294	
3	1.77E-04	1.54E+02	1.53E+02	0.620	
4	2.20E-04	1.22E+02	1.24E+02	-0.930	
5	2.80E-04	9.99E+01	1.02E+02	-2.227	
6	3.55E-04	8.60E+01	8.89E+01	-3.232	
7	4.43E-04	7.96E+01	8.13E+01	-2.072	
8	5.64E-04	7.66E+01	7.70E+01	-0.521	
9	7.13E-04	7.75E+01	7.59E+01	2.137	
10	8.81E-04	7.91E+01	7.72E+01	2.417	
11	1.10E-03	8.27E+01	8.07E+01	2.356	
12	1.41E-03	8.86E+01	8.75E+01	1.289	
13	1.77E-03	9.56E+01	9.57E+01	-0.022	
14	1.80E-03	9.68E+01	9.62E+01	0.553	
15	2.20E-03	1.04E+02	1.05E+02	-0.887	
16	2.22E-03	1.07E+02	1.05E+02	1.328	
17	2.80E-03	1.13E+02	1.15E+02	-1.215	
18	3.55E-03	1.20E+02	1.21E+02	-1.517	
19	4.43E-03	1.20E+02	1.22E+02	-1.578	
20	5.64E-03	1.19E+02	1.17E+02	1.548	
21	7.13E-03	1.11E+02	1.08E+02	3.099	
22	8.81E-03	9.68E+01	9.81E+01	-1.382	
23	1.10E-02	8.71E+01	8.84E+01	-1.408	

R: 227. X: 0. Y: 228. DL: 455. REQ: 253. CF: 1.0000
CLHZ ARRAY, 23 DATA POINTS, RAMP: 160.0 MICROSEC, DATA: PB19
1208 PB 1900WZ OPR XTL L 6 8 +100
Ch.21 = 0.16 Ch.22 = 0.89 Ch.23 = 11 Ch.24 = 20
RMS LOG ERROR: 1.31E-02, ANTILOG YIELDS 3.0574 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

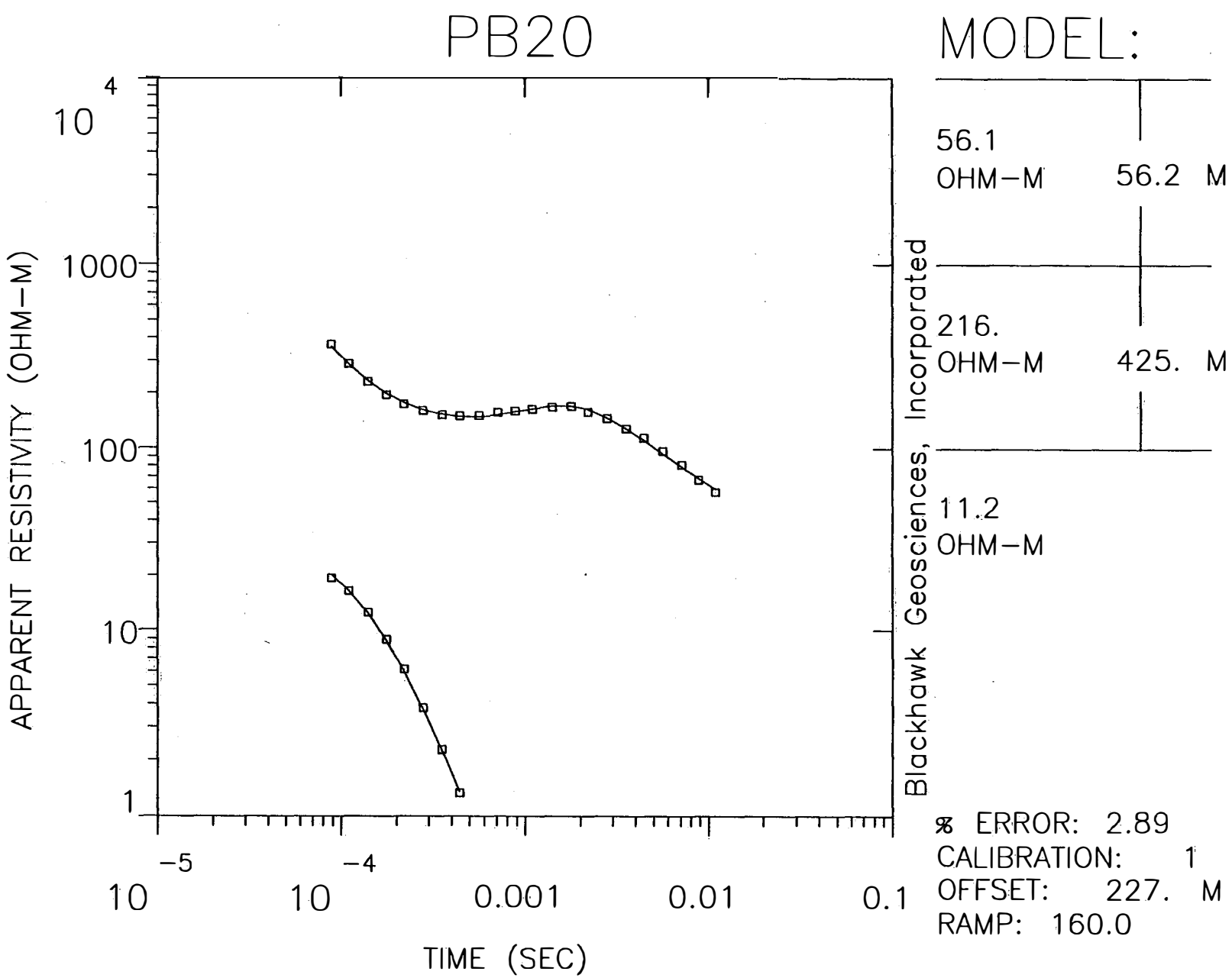
PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	1.00				
P 2	0.00	0.82			
P 3	0.00	-0.04	0.97		
T 1	0.00	-0.02	0.00	1.00	
T 2	0.00	0.02	0.01	0.00	1.00

P 1 P 2 P 3 T 1 T 2

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	36.757	38.653	40.201
	2	373.248	677.273	1092.274
	3	14.793	21.915	28.907
THICK	1	88.036	99.118	108.731
	2	472.653	500.681	543.345
DEPTH	1	88.036	99.118	108.731
	2	575.114	599.799	637.903


PB20
MODEL:
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
56.1
OHM-M
56.2 M
216.
OHM-M
425. M
11.2
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 2.89
CALIBRATION: 1
OFFSET: 227. M
RAMP: 160.0

PB20

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		377.0	1237.0		
56.08	56.2	320.9	1052.8	1.0	1.0
216.09	425.2	-104.4	-342.4	2.0	3.0
11.18					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	3.68E+02	3.58E+02	2.778	
2	1.10E-04	2.88E+02	2.87E+02	0.351	
3	1.40E-04	2.31E+02	2.33E+02	-0.973	
4	1.77E-04	1.96E+02	1.99E+02	-1.487	
5	2.20E-04	1.74E+02	1.77E+02	-1.812	
6	2.80E-04	1.60E+02	1.62E+02	-0.785	
7	3.55E-04	1.52E+02	1.53E+02	-0.560	
8	4.43E-04	1.50E+02	1.49E+02	0.865	
9	5.64E-04	1.51E+02	1.49E+02	1.635	
10	7.13E-04	1.57E+02	1.52E+02	2.788	
11	8.81E-04	1.60E+02	1.58E+02	1.262	
12	1.10E-03	1.64E+02	1.64E+02	-0.249	
13	1.41E-03	1.68E+02	1.70E+02	-1.493	
14	1.80E-03	1.69E+02	1.70E+02	-0.362	
15	2.20E-03	1.57E+02	1.63E+02	-3.203	
16	2.80E-03	1.45E+02	1.47E+02	-1.451	
17	3.55E-03	1.28E+02	1.28E+02	-0.314	
18	4.43E-03	1.14E+02	1.11E+02	2.833	
19	5.64E-03	9.63E+01	9.33E+01	3.170	
20	7.13E-03	8.11E+01	7.92E+01	2.429	
21	8.81E-03	6.72E+01	6.85E+01	-1.954	
22	1.10E-02	5.77E+01	5.94E+01	-2.987	

R: 227. X: 0. Y: 228. DL: 455. REQ: 253. CF: 1.0000
CLHZ ARRAY, 22 DATA POINTS, RAMP: 160.0 MICROSEC, DATA: PB20
1208 PB 2000NZ OPR XTL L 6 8 +100
Ch.21 = 0.16 Ch.22 = 0.89 Ch.23 = 11 Ch.24 = 20
RMS LOG ERROR: 1.24E-02, ANTILOG YIELDS 2.8887 %
LATE TIME PARAMETERS

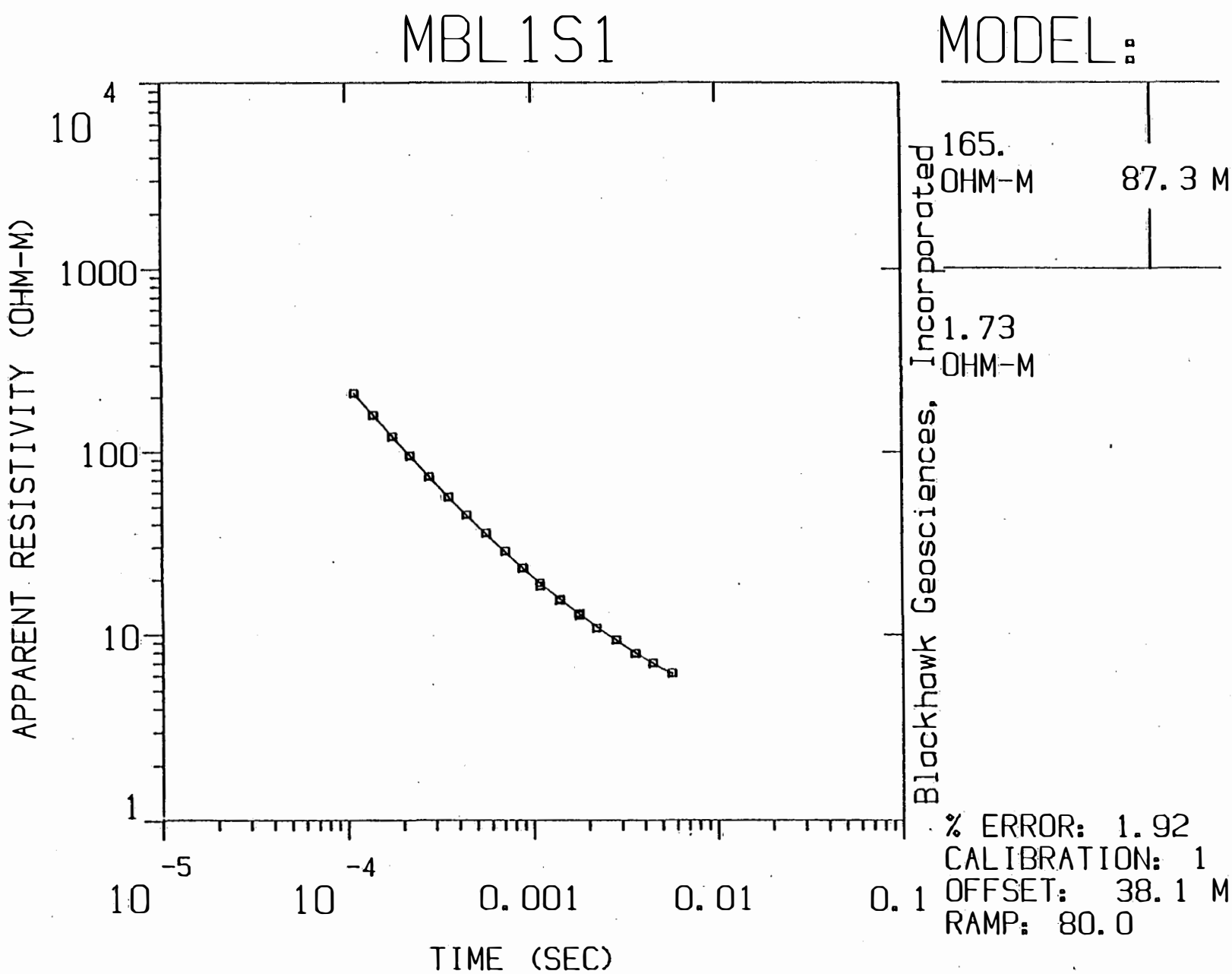
* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2
P 1	1.00				
P 2	0.00	1.00			
P 3	0.00	0.00	1.00		
T 1	0.00	-0.01	0.00	0.99	
T 2	0.00	0.00	0.00	0.00	1.00

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	49.381	56.082	65.099
	2	188.077	216.090	265.098
	3	9.075	11.175	13.930
THICK	1	42.234	56.158	79.231
	2	396.115	425.236	446.708
DEPTH	1	42.234	56.158	79.231
	2	471.959	481.394	492.100


MBL1S1
MODEL:
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
165.
OHM-M
87.3 M
1.73
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 1.92
CALIBRATION: 1
OFFSET: 38.1 M
RAMP: 80.0

MBL1S1

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		75.0	246.0		
165.43	87.3	-12.4	-40.5	0.5	0.5
1.73					

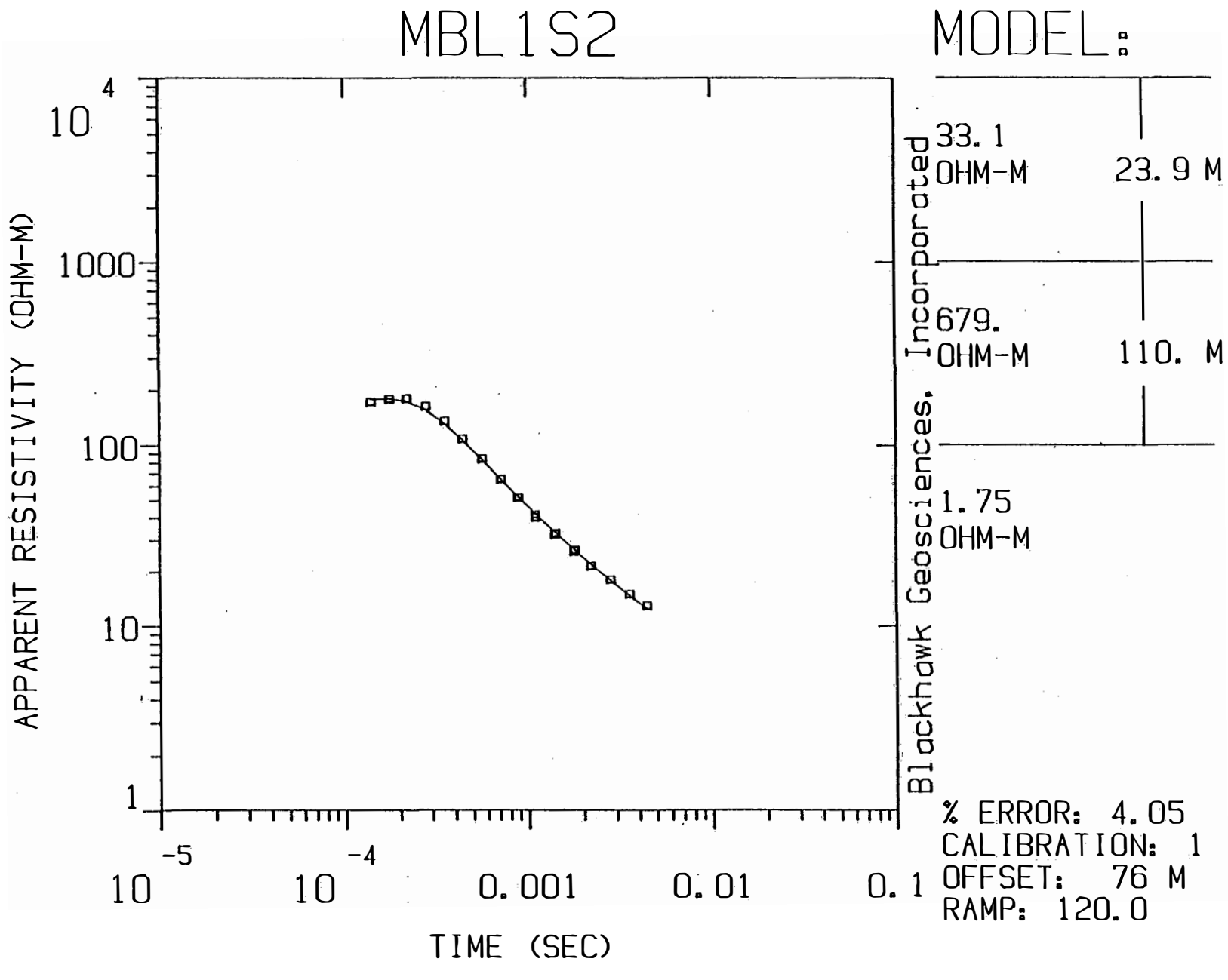
	TIMES	DATA	CALC	% ERROR	STD ERR
1	1.10E-04	2.10E+02	2.10E+02	-0.237	
2	1.40E-04	1.59E+02	1.59E+02	0.033	
3	1.77E-04	1.21E+02	1.21E+02	-0.221	
4	2.20E-04	9.48E+01	9.48E+01	-0.014	
5	2.80E-04	7.28E+01	7.26E+01	0.202	
6	3.55E-04	5.65E+01	5.63E+01	0.230	
7	4.43E-04	4.50E+01	4.48E+01	0.622	
8	5.64E-04	3.57E+01	3.51E+01	1.606	
9	7.13E-04	2.84E+01	2.80E+01	1.291	
10	8.81E-04	2.31E+01	2.31E+01	0.063	
11	8.90E-04	2.30E+01	2.29E+01	0.576	
12	1.10E-03	1.91E+01	1.90E+01	0.106	
13	1.10E-03	1.83E+01	1.90E+01	-3.556	
14	1.40E-03	1.53E+01	1.55E+01	-1.657	
15	1.41E-03	1.55E+01	1.54E+01	0.693	
16	1.77E-03	1.26E+01	1.29E+01	-2.024	
17	1.80E-03	1.30E+01	1.28E+01	1.770	
18	2.20E-03	1.08E+01	1.10E+01	-1.472	
19	2.80E-03	9.34E+00	9.27E+00	0.747	
20	3.55E-03	7.88E+00	7.95E+00	-0.846	
21	4.43E-03	7.00E+00	6.96E+00	0.620	
22	5.64E-03	6.18E+00	6.08E+00	1.639	

R: 38. X: 0. Y: 38. DL: 76. REQ: 42. CF: 1.0000
CLHZ ARRAY, 22 DATA POINTS, RAMP: 80.0 MICROSEC, DATA: MBL1S1
0502 100 1NZ OPR L 5 8 -
Ch.21 = 0.08 Ch.22 = 0.89 Ch.23 = 19.5 Ch.24 =
RMS LOG ERROR: 8.25E-03, ANTILOG YIELDS 1.9168 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.23		
P 2	-0.08	0.96	
T 1	0.03	0.00	1.00
	P 1	P 2	T 1


MBL1S2
MODEL:
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
33.1
OHM-M
23.9 M
679.
OHM-M
110. M
1.75
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 4.05
CALIBRATION: 1
OFFSET: 76 M
RAMP: 120.0

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		120.1	394.0		
33.08	23.9	96.2	315.5	0.7	0.7
678.91	110.2	-14.0	-46.0	0.2	0.9
1.75					

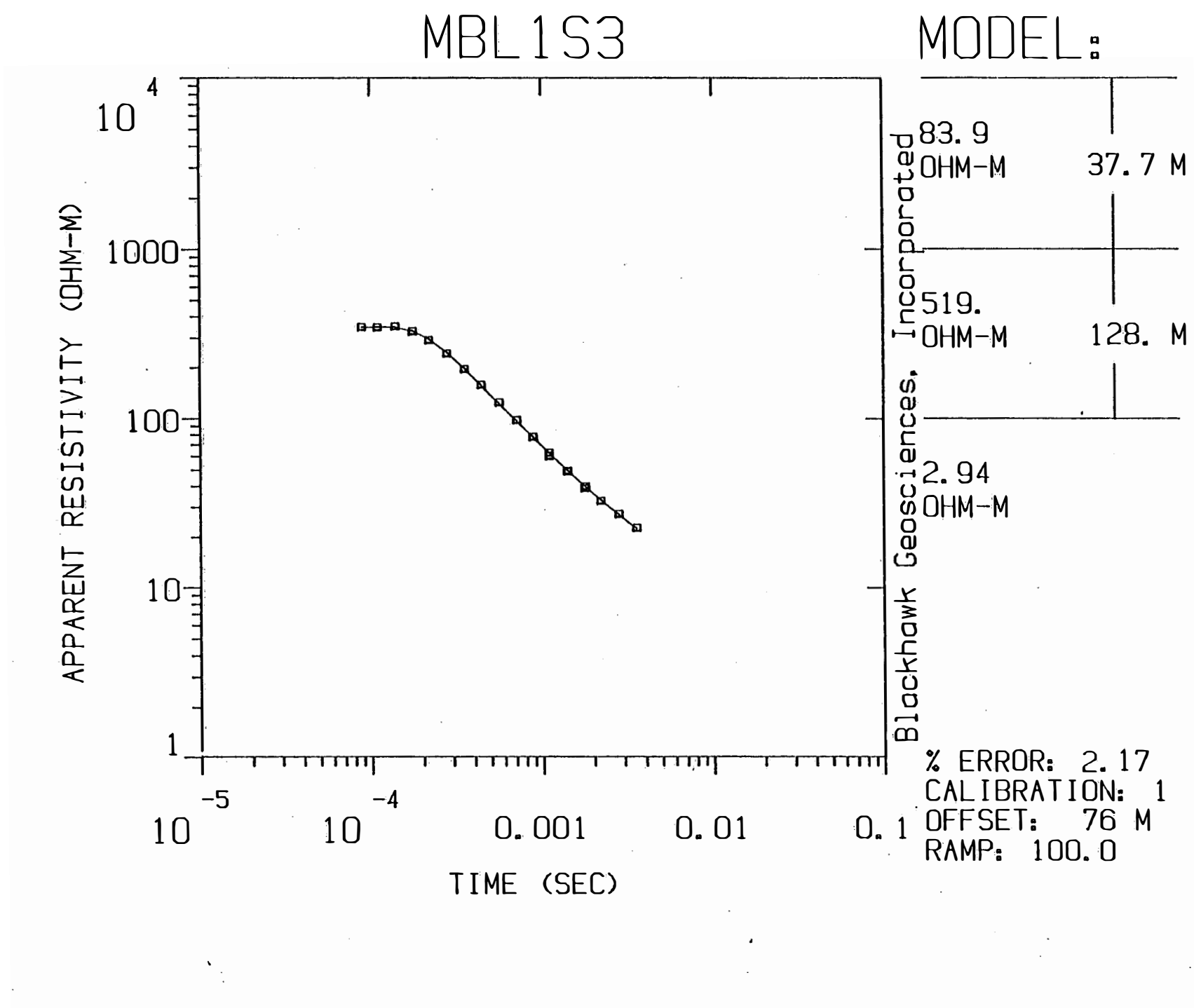
	TIMES	DATA	CALC	% ERROR	STD ERR
1	1.40E-04	1.73E+02	1.80E+02	-3.917	
2	1.77E-04	1.79E+02	1.81E+02	-1.087	
3	2.20E-04	1.81E+02	1.75E+02	3.366	
4	2.80E-04	1.64E+02	1.57E+02	4.697	
5	3.55E-04	1.36E+02	1.31E+02	3.761	
6	4.43E-04	1.08E+02	1.06E+02	1.586	
7	5.64E-04	8.41E+01	8.33E+01	0.970	
8	7.13E-04	6.53E+01	6.53E+01	-0.037	
9	8.81E-04	5.18E+01	5.26E+01	-1.359	
10	8.90E-04	5.18E+01	5.20E+01	-0.419	
11	1.10E-03	4.16E+01	4.22E+01	-1.396	
12	1.10E-03	4.02E+01	4.20E+01	-4.457	
13	1.40E-03	3.22E+01	3.32E+01	-3.245	
14	1.41E-03	3.28E+01	3.30E+01	-0.615	
15	1.77E-03	2.59E+01	2.67E+01	-3.037	
16	1.80E-03	2.65E+01	2.63E+01	0.511	
17	2.20E-03	2.15E+01	2.19E+01	-1.804	
18	2.80E-03	1.80E+01	1.78E+01	1.230	
19	3.55E-03	1.49E+01	1.47E+01	1.903	
20	4.43E-03	1.29E+01	1.24E+01	4.554	

R: 76. X: 0. Y: 76. DL: 152. REQ: 84. CF: 1.0000
CLHZ ARRAY, 20 DATA POINTS, RAMP: 120.0 MICROSEC, DATA: MBL1S2
0S02 100 2NZ OPR L 5 8 -
Ch.21 = 0.12 Ch.22 = 0.89 Ch.23 = 19 Ch.24 = 23
RMS LOG ERROR: 1.73E-02, ANTILOG YIELDS 4.0524 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.52				
P 2	0.03	0.00			
P 3	-0.03	-0.01	0.18		
T 1	-0.43	-0.03	0.06	0.41	
T 2	0.10	0.01	0.00	0.11	0.95
	P 1	P 2	P 3	T 1	T 2


MBL1S3
MODEL:
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
83.9
OHM-M
37.7 M
519.
OHM-M
128. M
2.94
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 2.17
CALIBRATION: 1
OFFSET: 76 M
RAMP: 100.0

MBL1S3

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		154.8	508.0		
83.87	37.7	117.2	384.4	0.4	0.4
518.60	128.1	-10.9	-35.8	0.2	0.7
2.94					

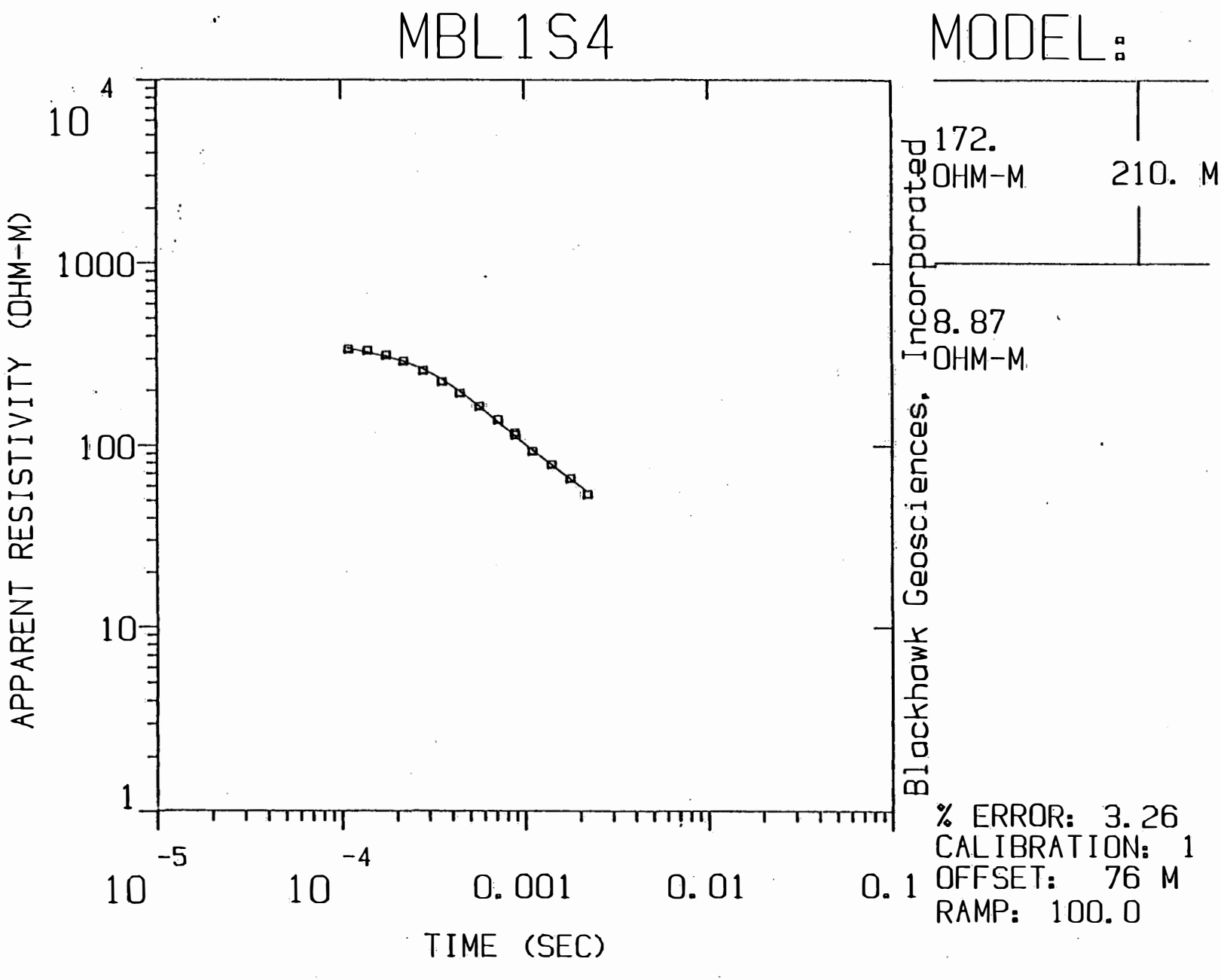
	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	3.46E+02	3.46E+02	0.101	
2	1.10E-04	3.45E+02	3.48E+02	-0.767	
3	1.40E-04	3.50E+02	3.46E+02	1.312	
4	1.77E-04	3.27E+02	3.28E+02	-0.313	
5	2.20E-04	2.91E+02	2.95E+02	-1.261	
6	2.80E-04	2.42E+02	2.46E+02	-1.460	
7	3.55E-04	1.96E+02	1.97E+02	-0.381	
8	4.43E-04	1.59E+02	1.57E+02	0.891	
9	5.64E-04	1.25E+02	1.22E+02	2.067	
10	7.13E-04	9.77E+01	9.61E+01	1.679	
11	8.81E-04	7.78E+01	7.76E+01	0.295	
12	8.90E-04	7.78E+01	7.68E+01	1.299	
13	1.10E-03	6.27E+01	6.26E+01	0.188	
14	1.10E-03	6.01E+01	6.23E+01	-3.560	
15	1.40E-03	4.89E+01	4.95E+01	-1.309	
16	1.41E-03	4.94E+01	4.92E+01	0.476	
17	1.77E-03	3.89E+01	4.00E+01	-2.642	
18	1.80E-03	4.00E+01	3.95E+01	1.299	
19	2.20E-03	3.27E+01	3.30E+01	-1.067	
20	2.80E-03	2.73E+01	2.70E+01	0.988	
21	3.55E-03	2.26E+01	2.24E+01	1.122	

R: 76. X: 0. Y: 76. DL: 152. REQ: 84. CF: 1.0000
CLHZ ARRAY, 21 DATA POINTS, RAMP: 100.0 MICROSEC, DATA: MBL1S3
0602 100N 3NZ OPR L 5 8 -TXP=3 1
Ch.21 = 0.1 Ch.22 = 0.89 Ch.23 = 15.5 Ch.24 = 2
RMS LOG ERROR: 9.34E-03, ANTILOG YIELDS 2.1734 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.78				
P 2	0.04	0.05			
P 3	0.04	-0.04	0.90		
T 1	-0.29	-0.15	0.07	0.57	
T 2	0.08	0.05	-0.02	0.12	0.97
	P 1	P 2	P 3	T 1	T 2


MBL1S4
MODEL:
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
172.
OHM-M
210. M
8.87
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 3.26
CALIBRATION: 1
OFFSET: 76 M
RAMP: 100.0

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	(FEET)	CONDUCTANCE (S) LAYER	TOTAL
		219.5	720.0		
171.55	210.3	9.1	29.9	1.2	1.2
8.87					

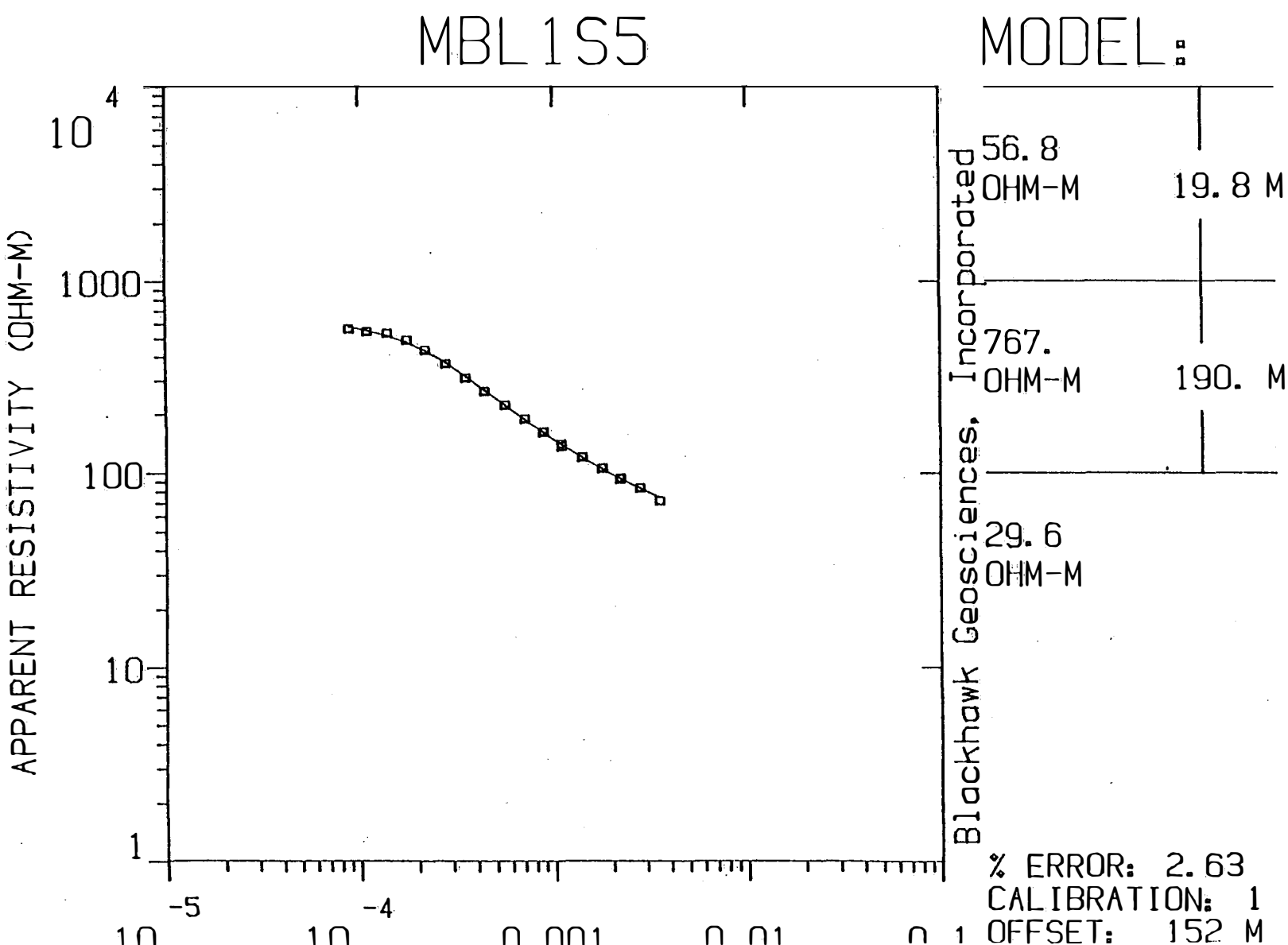
	TIMES	DATA	CALC	% ERROR	STD ERR
1	1.10E-04	3.37E+02	3.43E+02	-1.533	
2	1.40E-04	3.32E+02	3.24E+02	2.413	
3	1.77E-04	3.13E+02	3.08E+02	1.754	
4	2.20E-04	2.91E+02	2.90E+02	0.374	
5	2.80E-04	2.57E+02	2.63E+02	-2.211	
6	3.55E-04	2.23E+02	2.30E+02	-2.918	
7	4.43E-04	1.92E+02	1.97E+02	-2.320	
8	5.64E-04	1.63E+02	1.63E+02	-0.021	
9	7.13E-04	1.38E+02	1.34E+02	2.553	
10	8.81E-04	1.17E+02	1.13E+02	3.892	
11	8.90E-04	1.14E+02	1.12E+02	1.586	
12	1.10E-03	9.26E+01	9.42E+01	-1.612	
13	1.40E-03	7.83E+01	7.79E+01	0.523	
14	1.77E-03	6.57E+01	6.52E+01	0.680	
15	2.20E-03	5.40E+01	5.58E+01	-3.295	

R: 76. X: 0. Y: 76. DL: 152. REQ: 84. CF: 1.0000
CLHZ ARRAY, 15 DATA POINTS, RAMP: 100.0 MICROSEC, DATA: MBL1S4
0602 100N 4NZ OPR L 6 8 -TXP=4
Ch.21 = 0.1 Ch.22 = 0.89 Ch.23 = 15.5 Ch.24 = 2
RMS LOG ERROR: 1.39E-02, ANTILOG YIELDS 3.2579 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	1.00		
P 2	0.00	1.00	
T 1	0.00	0.00	1.00
	P 1	P 2	T 1


MBL1S5
MODEL:
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
-5
-4
10
10
0.001
0.01
0.1
56.8
OHM-M
19.8 M
767.
OHM-M
190. M
29.6
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 2.63
CALIBRATION: 1
OFFSET: 152 M

MBL1S5

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		270.1	886.0		
56.75	19.8	250.2	821.0	0.3	0.3
767.35	190.1	60.1	197.2	0.2	0.6
29.63					

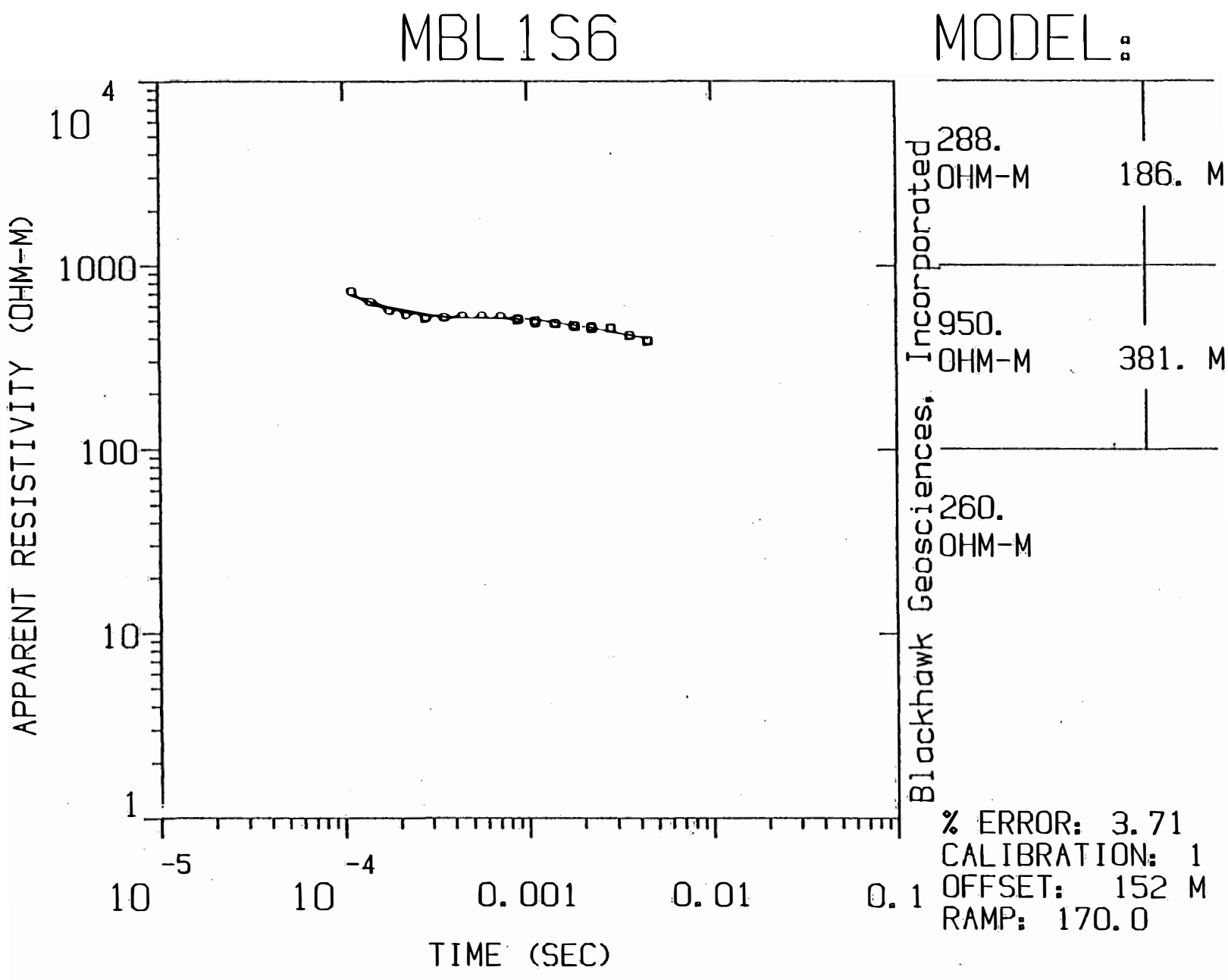
	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	5.66E+02	5.78E+02	-2.127	
2	1.10E-04	5.47E+02	5.51E+02	-0.732	
3	1.40E-04	5.37E+02	5.18E+02	3.591	
4	1.77E-04	4.91E+02	4.78E+02	2.765	
5	2.20E-04	4.35E+02	4.31E+02	0.965	
6	2.80E-04	3.67E+02	3.72E+02	-1.306	
7	3.55E-04	3.09E+02	3.15E+02	-1.914	
8	4.43E-04	2.63E+02	2.67E+02	-1.400	
9	5.64E-04	2.22E+02	2.22E+02	0.091	
10	7.13E-04	1.89E+02	1.87E+02	0.814	
11	8.81E-04	1.61E+02	1.61E+02	-0.025	
12	8.90E-04	1.63E+02	1.60E+02	1.663	
13	1.10E-03	1.40E+02	1.40E+02	0.647	
14	1.10E-03	1.37E+02	1.39E+02	-1.817	
15	1.40E-03	1.20E+02	1.20E+02	0.362	
16	1.41E-03	1.21E+02	1.19E+02	1.248	
17	1.77E-03	1.05E+02	1.05E+02	0.518	
18	1.80E-03	1.06E+02	1.04E+02	1.904	
19	2.20E-03	9.26E+01	9.33E+01	-0.727	
20	2.22E-03	9.43E+01	9.28E+01	1.620	
21	2.80E-03	8.37E+01	8.30E+01	0.903	
22	3.55E-03	7.18E+01	7.47E+01	-3.925	

R: 152. X: 0. Y: 152. DL: 304. REQ: 169. CF: 1.0000
CLHZ ARRAY, 22 DATA POINTS, RAMP: 175.0 MICROSEC, DATA: MBL1S5
0207 100N 5NZ OPR L 6 8 -LIN=100N 2
Ch.21 = 0.175 Ch.22 = 0.89 Ch.23 = 15 Ch.24 = 9
RMS LOG ERROR: 1.13E-02, ANTILOG YIELDS 2.6328 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.66				
P 2	0.02	0.13			
P 3	0.03	-0.04	0.97		
T 1	-0.37	-0.20	0.03	0.53	
T 2	0.03	0.06	0.01	0.05	0.99
	P 1	P 2	P 3	T 1	T 2


MBL1S6
MODEL:
APPARENT RESISTIVITY (OHM-M)
10 4
1000
100
10
1
10 -5
10 -4
0.001
0.01
0.1
TIME (SEC)
Blackhawk Geosciences, Incorporated
288.
OHM-M
186. M
950.
OHM-M
381. M
260.
OHM-M
% ERROR: 3.71
CALIBRATION: 1
OFFSET: 152 M
RAMP: 170.0

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		365.2	1198.0		
288.15	186.4	178.8	586.6	0.6	0.6
949.63	381.0	-202.2	-663.3	0.4	1.0
259.96					

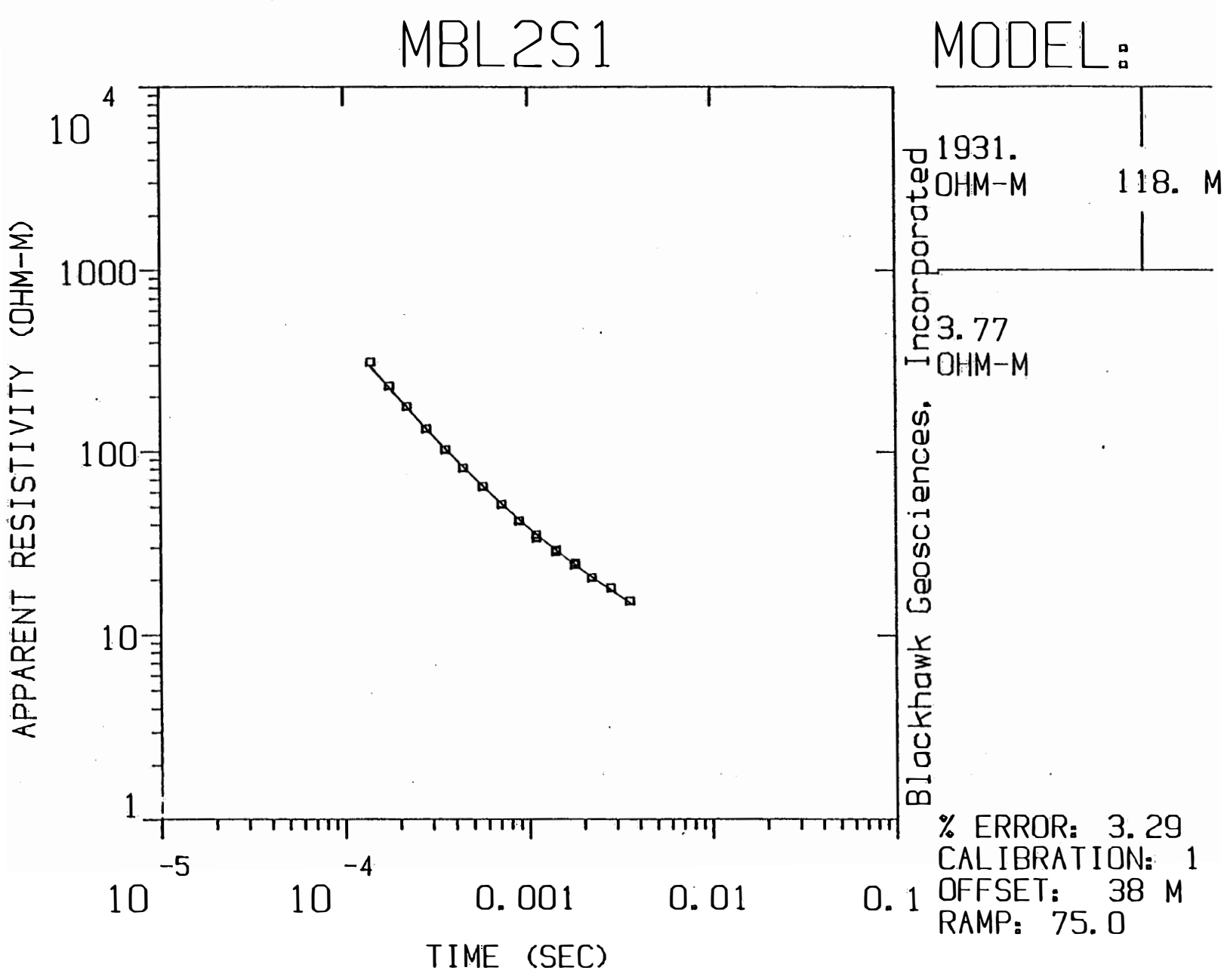
	TIMES	DATA	CALC	% ERROR	STD ERR
1	1.10E-04	7.15E+02	6.85E+02	4.483	
2	1.40E-04	6.27E+02	6.21E+02	0.820	
3	1.77E-04	5.60E+02	5.78E+02	-3.025	
4	2.20E-04	5.34E+02	5.50E+02	-2.950	
5	2.80E-04	5.17E+02	5.31E+02	-2.556	
6	3.55E-04	5.23E+02	5.21E+02	0.430	
7	4.43E-04	5.32E+02	5.18E+02	2.762	
8	5.64E-04	5.37E+02	5.17E+02	3.917	
9	7.13E-04	5.33E+02	5.16E+02	3.373	
10	8.81E-04	5.10E+02	5.12E+02	-0.410	
11	8.90E-04	5.20E+02	5.12E+02	1.647	
12	1.10E-03	4.99E+02	5.04E+02	-1.071	
13	1.10E-03	4.85E+02	5.04E+02	-3.845	
14	1.40E-03	4.84E+02	4.91E+02	-1.372	
15	1.41E-03	4.83E+02	4.90E+02	-1.378	
16	1.77E-03	4.75E+02	4.74E+02	0.305	
17	1.80E-03	4.68E+02	4.73E+02	-0.987	
18	2.20E-03	4.64E+02	4.56E+02	1.616	
19	2.22E-03	4.55E+02	4.55E+02	-0.173	
20	2.80E-03	4.56E+02	4.36E+02	4.524	
21	3.55E-03	4.17E+02	4.17E+02	-0.059	
22	4.43E-03	3.92E+02	4.01E+02	-2.217	

R: 152. X: 0. Y: 152. DL: 304. REQ: 169. CF: 1.0000
CLHZ ARRAY, 22 DATA POINTS, RAMP: 170.0 MICROSEC, DATA: MBL1S6
0207 100N 66NZ OPR L 7 10-
Ch.21 = 0.17 Ch.22 = 0.89 Ch.23 = 15 Ch.24 = 92
RMS LOG ERROR: 1.58E-02, ANTILOG YIELDS 3.7115 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.98				
P 2	-0.06	0.49			
P 3	0.01	-0.05	0.90		
T 1	-0.07	-0.31	0.02	0.73	
T 2	0.03	0.32	0.09	0.17	0.75
	P 1	P 2	P 3	T 1	T 2


MBL2S1
MODEL:
1931.
OHM-M
118. M
3.77
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 3.29
CALIBRATION: 1
OFFSET: 38 M
RAMP: 75.0
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)

MBL2S1

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		114.9	377.0		
1931.42	118.3	-3.4	-11.2	0.1	0.1
3.77					

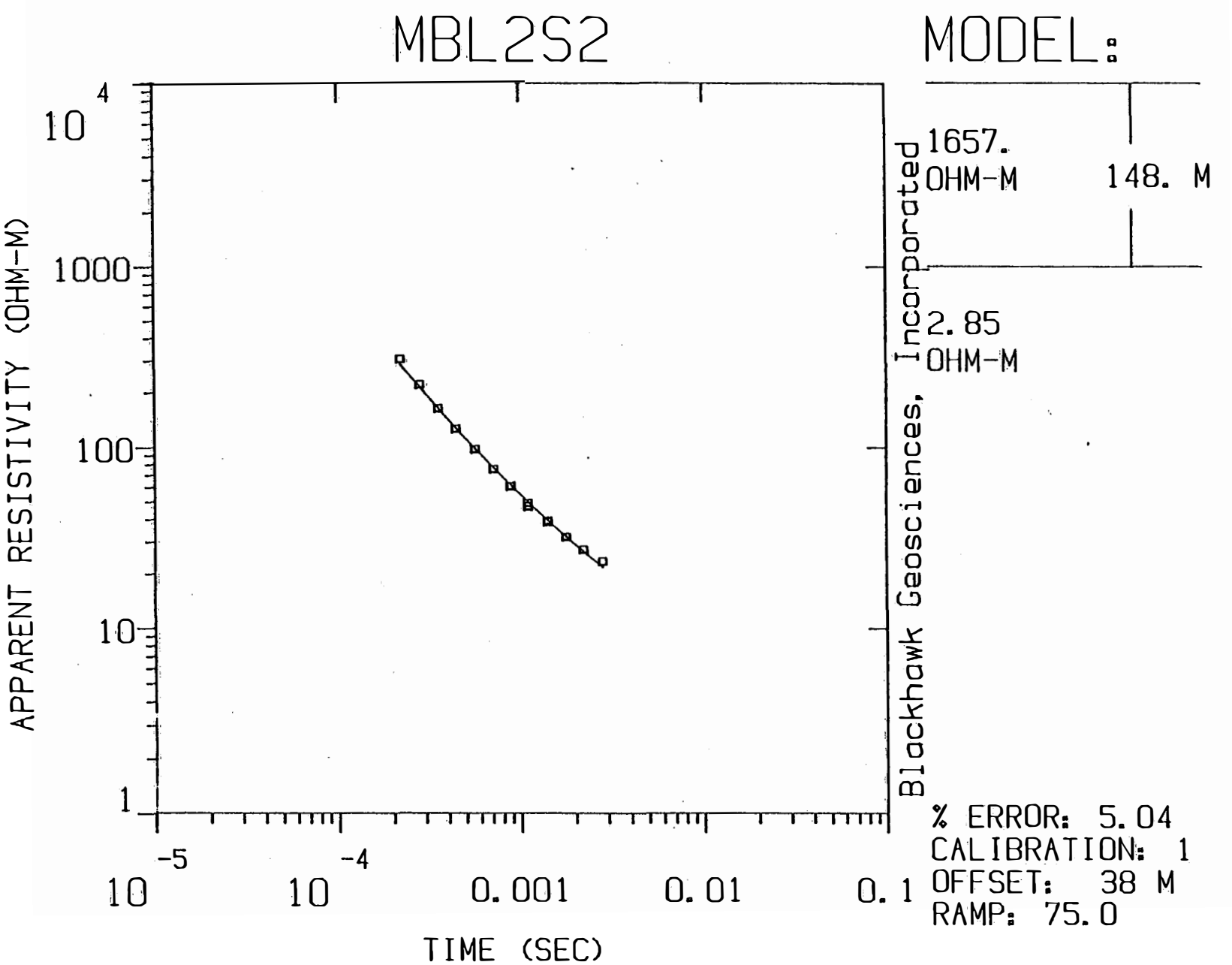
	TIMES	DATA	CALC	% ERROR	STD ERR
1	1.40E-04	3.12E+02	2.96E+02	5.258	
2	1.77E-04	2.30E+02	2.24E+02	2.326	
3	2.20E-04	1.76E+02	1.75E+02	0.759	
4	2.80E-04	1.33E+02	1.34E+02	-0.447	
5	3.55E-04	1.02E+02	1.04E+02	-1.349	
6	4.43E-04	8.13E+01	8.26E+01	-1.609	
7	5.64E-04	6.45E+01	6.49E+01	-0.648	
8	7.13E-04	5.16E+01	5.20E+01	-0.746	
9	8.81E-04	4.22E+01	4.30E+01	-1.879	
10	8.90E-04	4.21E+01	4.27E+01	-1.296	
11	1.10E-03	3.53E+01	3.55E+01	-0.703	
12	1.10E-03	3.39E+01	3.54E+01	-4.202	
13	1.40E-03	2.85E+01	2.92E+01	-2.260	
14	1.41E-03	2.92E+01	2.90E+01	0.696	
15	1.77E-03	2.41E+01	2.43E+01	-0.720	
16	1.80E-03	2.48E+01	2.41E+01	3.047	
17	2.20E-03	2.06E+01	2.07E+01	-0.665	
18	2.80E-03	1.80E+01	1.76E+01	2.557	
19	3.55E-03	1.53E+01	1.50E+01	2.181	

R: 38. X: 0. Y: 38. DL: 76. REQ: 42. CF: 1.0000
CLHZ ARRAY, 19 DATA POINTS, RAMP: 75.0 MICROSEC, DATA: MBL2S1
0802 200N 1NZ OPR L 5 8 -TXL=76*76
Ch.21 = 0.075 Ch.22 = 0.89 Ch.23 = 19 Ch.24 = 5
RMS LOG ERROR: 1.41E-02, ANTILOG YIELDS 3.2943 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	T 1
P 1	0.03		
P 2	-0.09	0.34	
T 1	-0.01	0.05	0.97


MBL2S2
MODEL:
1657.
OHM-M
148. M
2.85
OHM-M
APPARENT RESISTIVITY (OHM-M)
10 4
1000
100
10
1
10 -5
10 -4
0.001
0.01
0.1
TIME (SEC)
Blackhawk Geosciences, Incorporated
% ERROR: 5.04
CALIBRATION: 1
OFFSET: 38 M
RAMP: 75.0

MBL2S2

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		144.8	475.0		
1656.55	147.8	-3.1	-10.0	0.1	0.1
2.85					

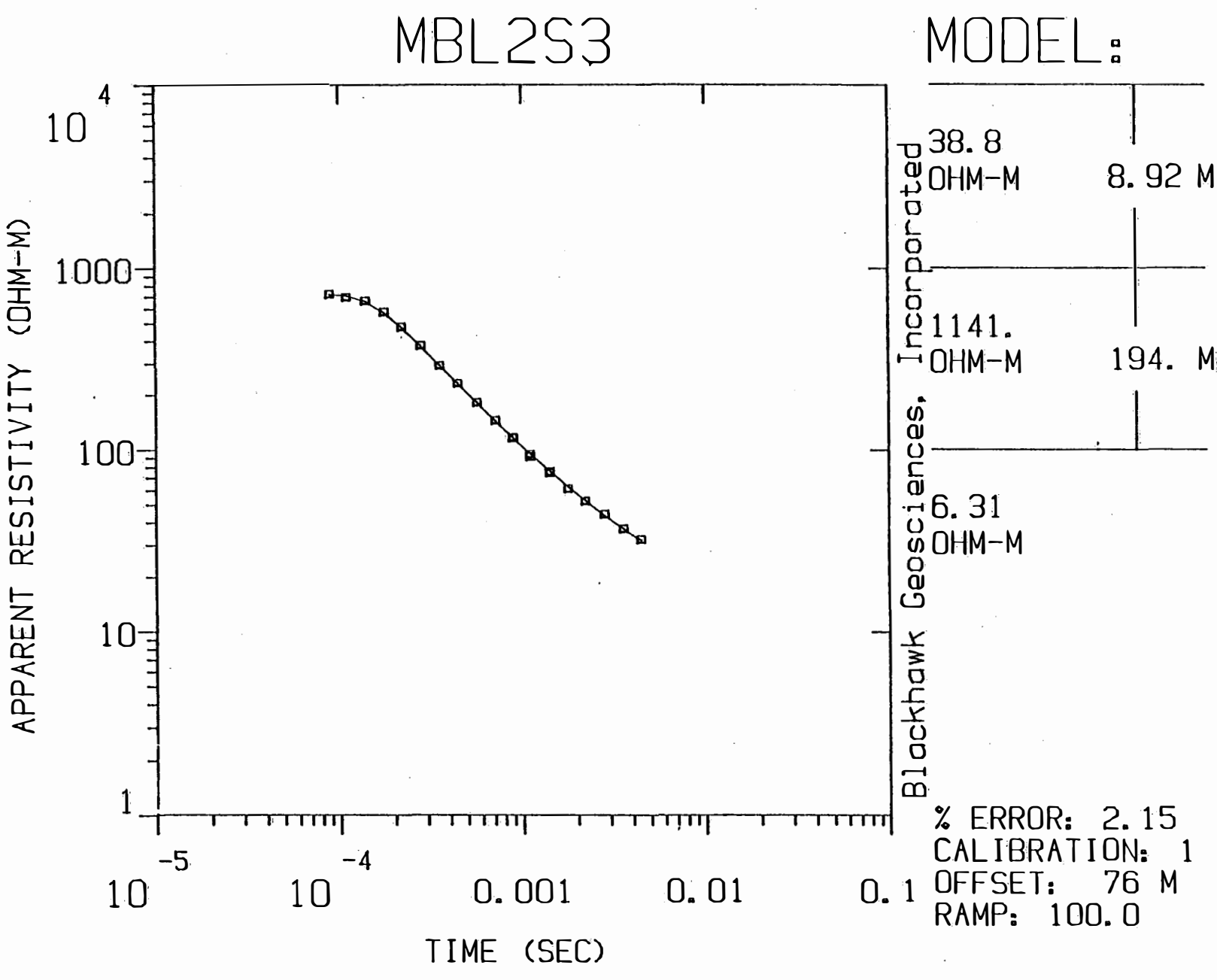
	TIMES	DATA	CALC	% ERROR	STD ERR
1	2.20E-04	3.07E+02	2.87E+02	6.932	
2	2.80E-04	2.22E+02	2.16E+02	2.562	
3	3.55E-04	1.64E+02	1.64E+02	-0.129	
4	4.43E-04	1.27E+02	1.28E+02	-1.177	
5	5.64E-04	9.75E+01	9.87E+01	-1.210	
6	7.13E-04	7.57E+01	7.69E+01	-1.646	
7	8.81E-04	6.06E+01	6.21E+01	-2.519	
8	8.90E-04	6.11E+01	6.15E+01	-0.684	
9	1.10E-03	4.92E+01	5.01E+01	-1.879	
10	1.10E-03	4.72E+01	4.99E+01	-5.536	
11	1.40E-03	3.87E+01	3.97E+01	-2.482	
12	1.41E-03	3.94E+01	3.94E+01	-0.061	
13	1.77E-03	3.20E+01	3.22E+01	-0.578	
14	2.20E-03	2.72E+01	2.66E+01	2.160	
15	2.80E-03	2.34E+01	2.18E+01	7.319	

R: 38. X: 0. Y: 38. DL: 76. REQ: 42. CF: 1.0000
CLHZ ARRAY, 15 DATA POINTS, RAMP: 75.0 MICROSEC, DATA: MBL2S2
0802 200N 2NZ OPR L 5 10-
Ch.21 = 0.075 Ch.22 = 0.89 Ch.23 = 19 Ch.24 = 5
RMS LOG ERROR: 2.13E-02, ANTILOG YIELDS 5.0389 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.05		
P 2	-0.01	0.89	
T 1	0.00	0.00	1.00
	P 1	P 2	T 1


MBL2S3
MODEL:
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
38.8
OHM-M
8.92 M
1141.
OHM-M
194. M
6.31
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 2.15
CALIBRATION: 1
OFFSET: 76 M
RAMP: 100.0

MBL2S3

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	(FEET)	CONDUCTANCE (S) LAYER	TOTAL
		175.0	574.0		
38.80	8.9	166.0	544.7	0.2	0.2
1141.01	194.1	-28.0	-91.9	0.2	0.4
6.31					

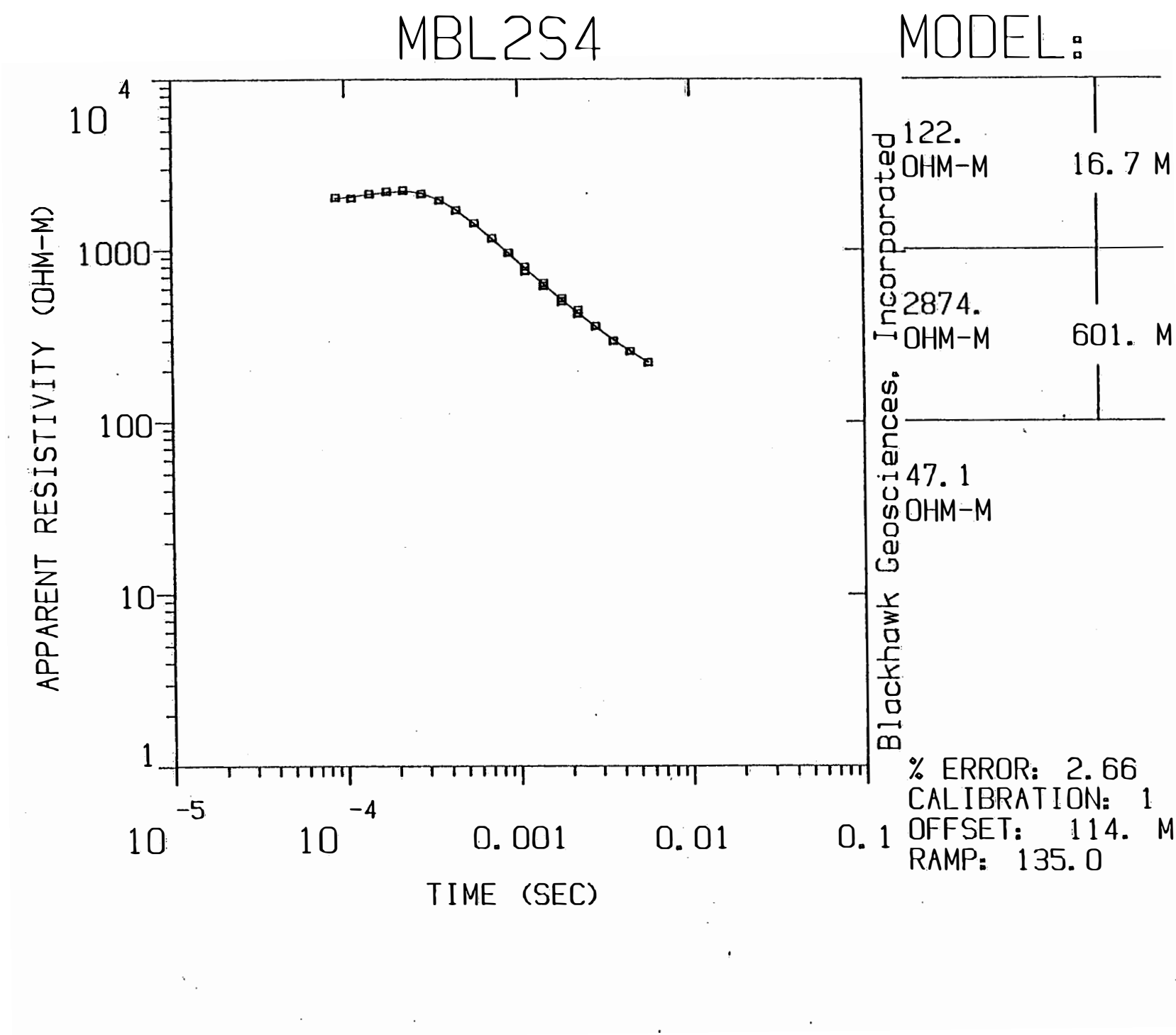
	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	7.23E+02	7.20E+02	0.485	
2	1.10E-04	6.97E+02	7.10E+02	-1.926	
3	1.40E-04	6.65E+02	6.59E+02	0.941	
4	1.77E-04	5.78E+02	5.70E+02	1.330	
5	2.20E-04	4.78E+02	4.74E+02	0.817	
6	2.80E-04	3.77E+02	3.74E+02	0.949	
7	3.55E-04	2.92E+02	2.92E+02	-0.050	
8	4.43E-04	2.32E+02	2.32E+02	0.089	
9	5.64E-04	1.81E+02	1.81E+02	0.309	
10	7.13E-04	1.45E+02	1.43E+02	1.124	
11	8.81E-04	1.16E+02	1.17E+02	-0.470	
12	8.90E-04	1.17E+02	1.15E+02	1.415	
13	1.10E-03	9.45E+01	9.51E+01	-0.635	
14	1.10E-03	9.16E+01	9.48E+01	-3.365	
15	1.40E-03	7.45E+01	7.64E+01	-2.452	
16	1.41E-03	7.59E+01	7.58E+01	0.049	
17	1.77E-03	6.11E+01	6.25E+01	-2.295	
18	2.20E-03	5.24E+01	5.24E+01	-0.126	
19	2.80E-03	4.44E+01	4.36E+01	1.791	
20	3.55E-03	3.70E+01	3.68E+01	0.525	
21	4.43E-03	3.23E+01	3.17E+01	1.827	

R: 76. X: 0. Y: 76. DL: 152. REQ: 84. CF: 1.0000
CLHZ ARRAY, 21 DATA POINTS, RAMP: 100.0 MICROSEC, DATA: MBL2S3
0802 200N 3NZ OPR L 5 10-TXL=152*152
Ch.21 = 0.1 Ch.22 = 0.89 Ch.23 = 15.5 Ch.24 = 2
RMS LOG ERROR: 9.23E-03, ANTILOG YIELDS 2.1477 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.39				
P 2	0.09	0.02			
P 3	-0.04	-0.02	0.25		
T 1	-0.40	-0.10	0.06	0.43	
T 2	0.03	0.02	0.02	0.01	0.97
	P 1	P 2	P 3	T 1	T 2


MBL2S4
MODEL:
APPARENT RESISTIVITY (OHM-M)
10 4
1000
100
10
1
10 -5
10 -4
0.001
0.01
0.1
TIME (SEC)
122.
OHM-M
16.7 M
2874.
OHM-M
601. M
47.1
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 2.66
CALIBRATION: 1
OFFSET: 114. M
RAMP: 135.0

MBL2S4

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		254.8	836.0		
122.16	16.7	238.1	781.3	0.1	0.1
2874.18	600.9	-362.8	-1190.3	0.2	0.3
47.13					

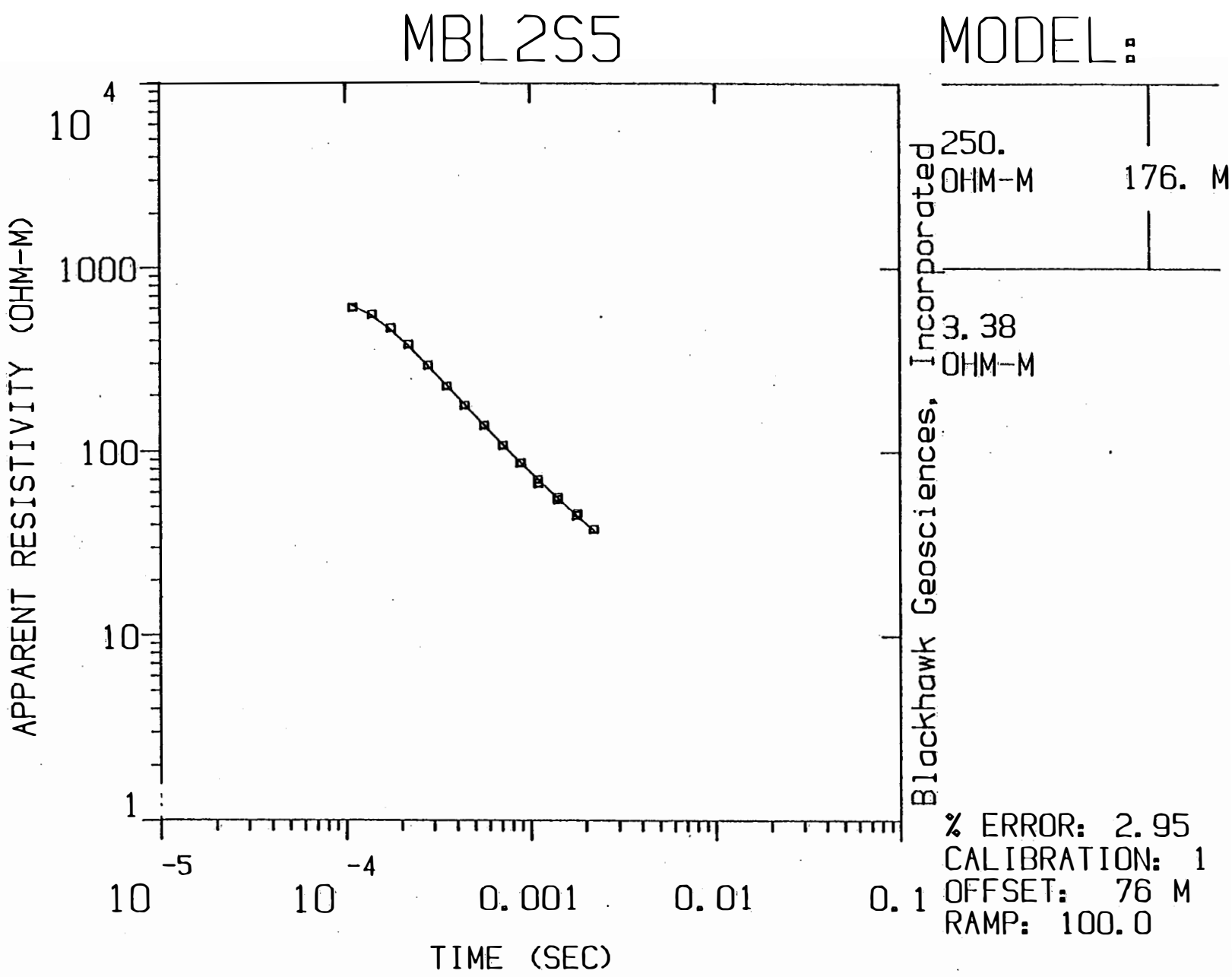
	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	2.06E+03	2.04E+03	0.863	
2	1.10E-04	2.05E+03	2.09E+03	-2.076	
3	1.40E-04	2.17E+03	2.16E+03	0.608	
4	1.77E-04	2.23E+03	2.22E+03	0.570	
5	2.20E-04	2.27E+03	2.25E+03	0.884	
6	2.80E-04	2.16E+03	2.18E+03	-0.786	
7	3.55E-04	1.98E+03	1.99E+03	-0.655	
8	4.43E-04	1.73E+03	1.74E+03	-0.511	
9	5.64E-04	1.44E+03	1.43E+03	0.782	
10	7.13E-04	1.17E+03	1.16E+03	0.735	
11	8.81E-04	9.62E+02	9.60E+02	0.167	
12	8.90E-04	9.63E+02	9.51E+02	1.226	
13	1.10E-03	7.96E+02	7.87E+02	1.077	
14	1.10E-03	7.54E+02	7.85E+02	-3.910	
15	1.40E-03	6.20E+02	6.35E+02	-2.366	
16	1.41E-03	6.42E+02	6.30E+02	1.886	
17	1.77E-03	5.04E+02	5.19E+02	-2.924	
18	1.80E-03	5.24E+02	5.13E+02	2.262	
19	2.20E-03	4.29E+02	4.34E+02	-1.345	
20	2.22E-03	4.49E+02	4.31E+02	4.339	
21	2.80E-03	3.63E+02	3.60E+02	0.874	
22	3.55E-03	2.98E+02	3.02E+02	-1.477	
23	4.43E-03	2.58E+02	2.59E+02	-0.300	
24	5.64E-03	2.22E+02	2.22E+02	-0.057	

R: 114. X: 0. Y: 115. DL: 229. REQ: 128. CF: 1.0000
CLHZ ARRAY, 24 DATA POINTS, RAMP: 135.0 MICROSEC, DATA: MBL2S4
0902 200N 44NZ OPR L 6 10-
Ch.21 = 0.135 Ch.22 = 0.89 Ch.23 = 14.5 Ch.24 =
RMS LOG ERROR: 1.14E-02, ANTILOG YIELDS 2.6616 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.56				
P 2	0.00	0.57			
P 3	0.03	-0.07	0.91		
T 1	-0.44	-0.20	0.00	0.47	
T 2	0.01	0.02	0.01	0.02	1.00
	P 1	P 2	P 3	T 1	T 2


MBL2S5
MODEL:
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
250.
OHM-M
176. M
3.38
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 2.95
CALIBRATION: 1
OFFSET: 76 M
RAMP: 100.0

MBL2SS

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		170.1	558.0		
250.03	176.4	-6.3	-20.8	0.7	0.7
3.38					

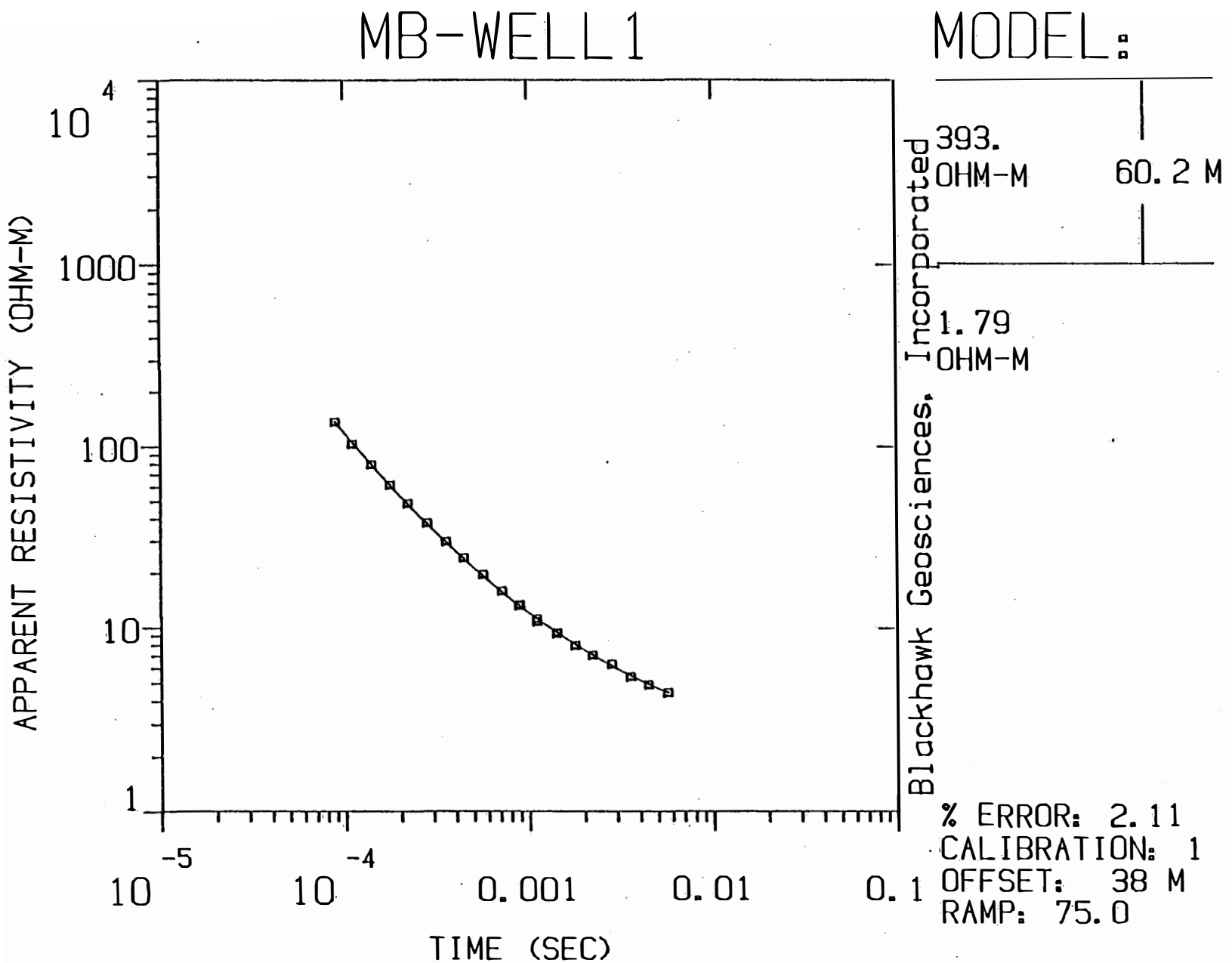
	TIMES	DATA	CALC	% ERROR	STD ERR
1	1.10E-04	6.08E+02	6.24E+02	-2.534	
2	1.40E-04	5.57E+02	5.47E+02	1.728	
3	1.77E-04	4.69E+02	4.58E+02	2.349	
4	2.20E-04	3.82E+02	3.75E+02	1.900	
5	2.80E-04	2.94E+02	2.93E+02	0.540	
6	3.55E-04	2.26E+02	2.27E+02	-0.657	
7	4.43E-04	1.77E+02	1.79E+02	-1.043	
8	5.64E-04	1.38E+02	1.39E+02	-0.426	
9	7.13E-04	1.08E+02	1.09E+02	-0.604	
10	8.81E-04	8.69E+01	8.76E+01	-0.849	
11	8.90E-04	8.69E+01	8.68E+01	0.177	
12	1.10E-03	7.06E+01	7.07E+01	-0.132	
13	1.10E-03	6.72E+01	7.04E+01	-4.555	
14	1.40E-03	5.48E+01	5.60E+01	-2.030	
15	1.41E-03	5.66E+01	5.56E+01	1.850	
16	1.77E-03	4.50E+01	4.52E+01	-0.422	
17	1.80E-03	4.63E+01	4.46E+01	3.708	
18	2.20E-03	3.80E+01	3.74E+01	1.799	

R: 76. X: 0. Y: 76. DL: 152. REQ: 84. CF: 1.0000
CLHZ ARRAY, 18 DATA POINTS, RAMP: 100.0 MICROSEC, DATA: MBL2SS
0902 200N 5NZ OPR L 5 10-TXP=5
Ch.21 = 0.1 Ch.22 = 0.89 Ch.23 = 15 Ch.24 = 231
RMS LOG ERROR: 1.26E-02, ANTILOG YIELDS 2.9478 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	1.00		
P 2	0.00	1.00	
T 1	0.00	0.00	1.00
	P 1	P 2	T 1


MB-WELL1
MODEL:
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
393.
OHM-M
60.2 M
1.79
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 2.11
CALIBRATION: 1
OFFSET: 38 M
RAMP: 75.0

MB-WELL1

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		59.7	196.0		
393.42	60.2	-0.5	-1.6	0.2	0.2
1.79					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	1.36E+02	1.37E+02	-0.283	
2	1.10E-04	1.03E+02	1.06E+02	-2.691	
3	1.40E-04	7.97E+01	7.98E+01	-0.152	
4	1.77E-04	6.14E+01	6.12E+01	0.403	
5	2.20E-04	4.87E+01	4.82E+01	0.936	
6	2.80E-04	3.78E+01	3.75E+01	1.015	
7	3.55E-04	2.98E+01	2.95E+01	0.934	
8	4.43E-04	2.42E+01	2.39E+01	1.272	
9	5.64E-04	1.96E+01	1.92E+01	1.954	
10	7.13E-04	1.59E+01	1.57E+01	1.331	
11	8.81E-04	1.32E+01	1.32E+01	-0.013	
12	8.90E-04	1.34E+01	1.31E+01	2.063	
13	1.10E-03	1.12E+01	1.12E+01	-0.198	
14	1.10E-03	1.08E+01	1.12E+01	-3.317	
15	1.40E-03	9.28E+00	9.41E+00	-1.395	
16	1.41E-03	9.41E+00	9.36E+00	0.445	
17	1.77E-03	7.97E+00	8.07E+00	-1.174	
18	2.20E-03	7.05E+00	7.06E+00	-0.211	
19	2.80E-03	6.30E+00	6.16E+00	2.203	
20	3.55E-03	5.40E+00	5.45E+00	-0.946	
21	4.43E-03	4.89E+00	4.91E+00	-0.483	
22	5.64E-03	4.44E+00	4.42E+00	0.418	

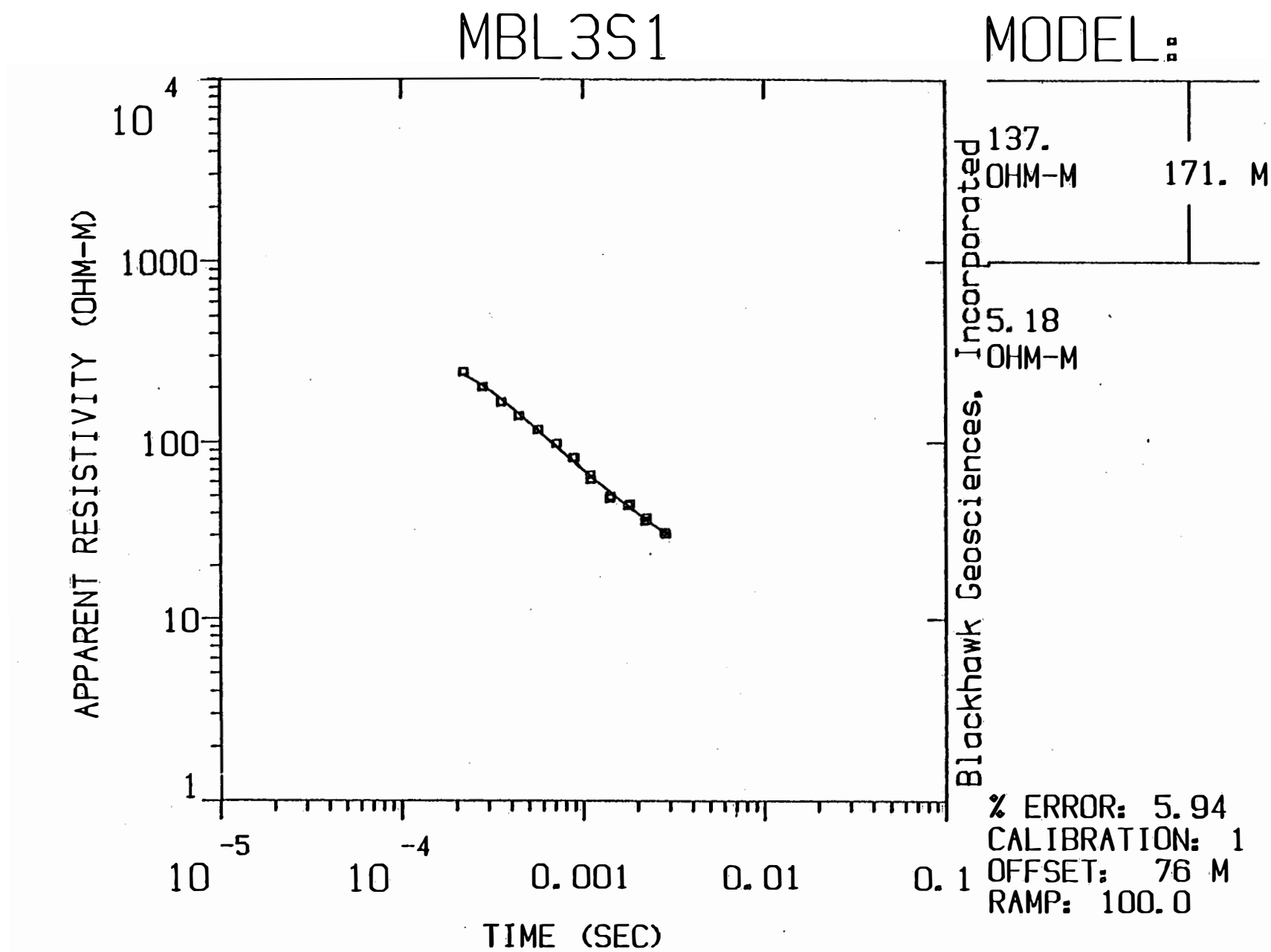
R: 38. X: 0. Y: 38. DL: 76. REQ: 42. CF: 1.0000
CLHZ ARRAY, 22 DATA POINTS, RAMP: 75.0 MICROSEC, DATA: MB-WELL1
0902 200N 6NZ OPR L 5 8 -TXP=6
Ch.21 = 0.075 Ch.22 = 0.89 Ch.23 = 19 Ch.24 = 5
RMS LOG ERROR: 9.09E-03, ANTILOG YIELDS 2.1145 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER
P 1 0.13
P 2 -0.01 1.00
T 1 0.01 0.00 1.00
P 1 P 2 T 1

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	164.535	393.419	1233.472
	2	1.717	1.788	1.891
THICK	1	59.459	60.242	60.810
DEPTH	1	59.459	60.242	60.810


MBL3S1
MODEL:
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
137.
OHM-M
171. M
5.18
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 5.94
CALIBRATION: 1
OFFSET: 76 M
RAMP: 100.0

MBL3S1

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		150.0	492.0		
136.75	171.0	-21.0	-69.0	1.3	1.3
5.18					

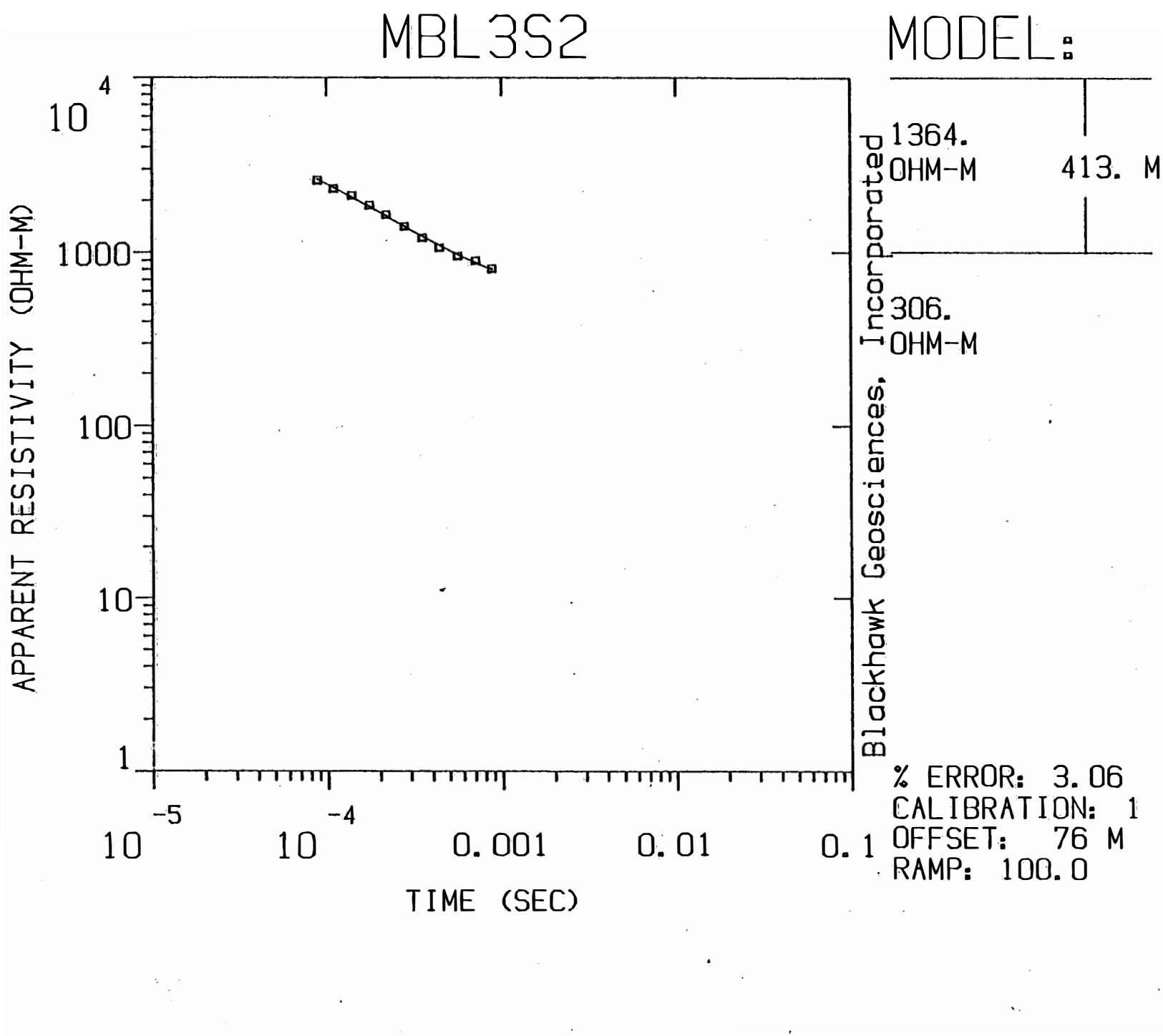
	TIMES	DATA	CALC	% ERROR	STD ERR
1	2.20E-04	2.44E+02	2.37E+02	3.217	
2	2.80E-04	2.01E+02	2.06E+02	-2.289	
3	3.55E-04	1.66E+02	1.73E+02	-3.951	
4	4.43E-04	1.40E+02	1.44E+02	-2.850	
5	5.64E-04	1.17E+02	1.16E+02	0.781	
6	7.13E-04	9.84E+01	9.41E+01	4.566	
7	8.81E-04	8.22E+01	7.80E+01	5.447	
8	8.90E-04	8.17E+01	7.73E+01	5.705	
9	1.10E-03	6.56E+01	6.45E+01	1.674	
10	1.10E-03	6.18E+01	6.43E+01	-4.013	
11	1.40E-03	4.84E+01	5.26E+01	-7.922	
12	1.41E-03	4.97E+01	5.23E+01	-4.951	
13	1.77E-03	4.41E+01	4.36E+01	1.091	
14	1.80E-03	4.50E+01	4.31E+01	4.413	
15	2.20E-03	3.61E+01	3.70E+01	-2.263	
16	2.22E-03	3.77E+01	3.67E+01	2.738	
17	2.80E-03	3.13E+01	3.11E+01	0.517	
18	2.85E-03	3.05E+01	3.07E+01	-0.845	

R: 76. X: 0. Y: 76. DL: 152. REQ: 84. CF: 1.0000
CLHZ ARRAY, 18 DATA POINTS, RAMP: 100.0 MICROSEC, DATA: MBL3S1
1002 300N 100NZ OPR L 5 10-TXL=152*152
Ch.21 = 0.1 Ch.22 = 0.89 Ch.23 = 15 Ch.24 = 231
RMS LOG ERROR: 2.51E-02, ANTILOG YIELDS 5.9386 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	1.00		
P 2	0.00	1.00	
T 1	0.00	0.00	1.00
	P 1	P 2	T 1


MBL3S2
MODEL:
APPARENT RESISTIVITY (OHM-M)
10 4
1000
100
10
1
10 -5
10 -4
0.001
0.01
0.1
TIME (SEC)
1364.
OHM-M
413. M
306.
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 3.06
CALIBRATION: 1
OFFSET: 76 M
RAMP: 100.0

MBL3S2

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		246.9	810.0		
1363.71	413.0	-166.1	-545.0	0.3	0.3
306.13					

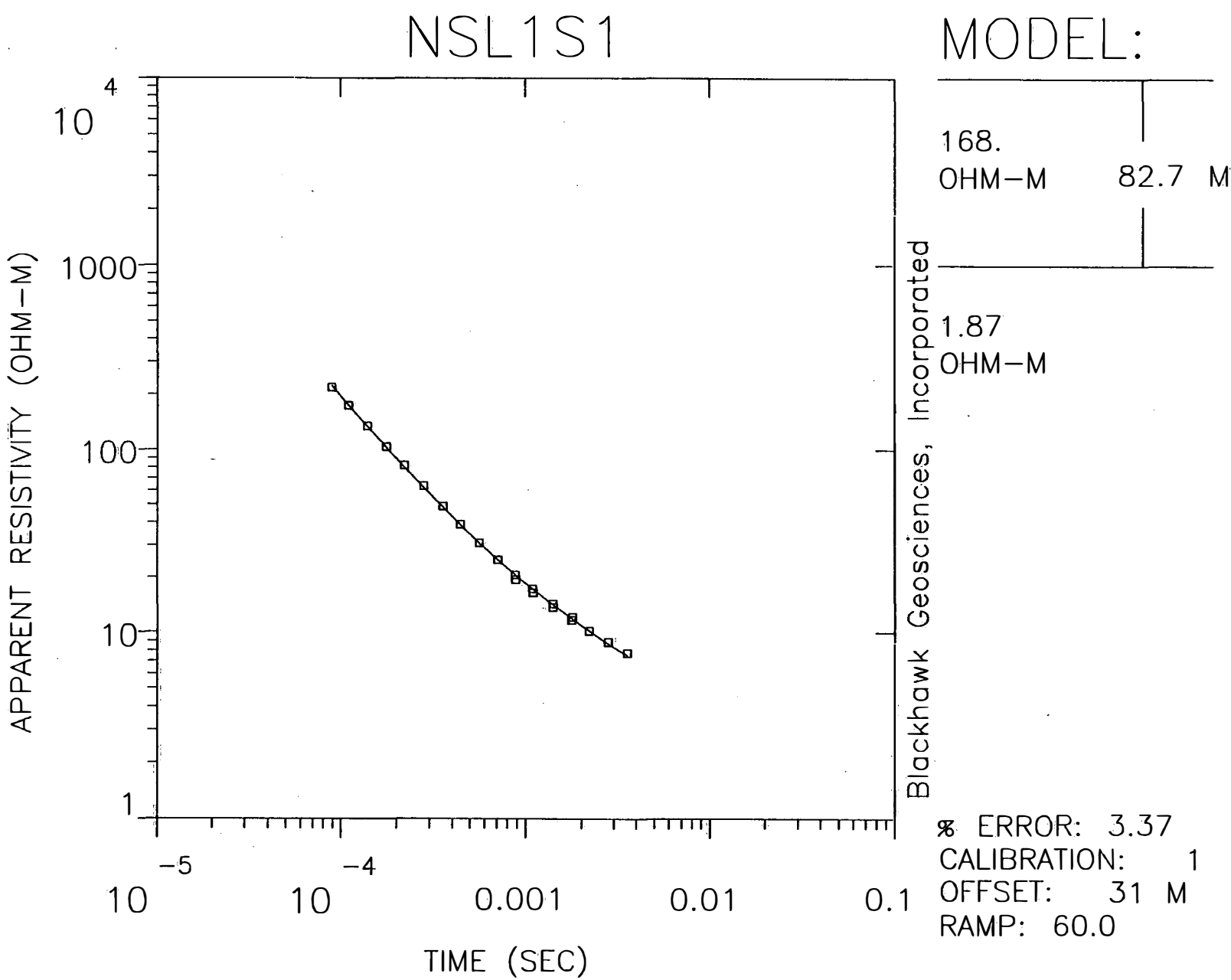
	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	2.61E+03	2.64E+03	-1.194	
2	1.10E-04	2.34E+03	2.37E+03	-1.492	
3	1.40E-04	2.14E+03	2.09E+03	2.112	
4	1.77E-04	1.88E+03	1.84E+03	2.059	
5	2.20E-04	1.65E+03	1.62E+03	1.833	
6	2.80E-04	1.42E+03	1.41E+03	0.186	
7	3.55E-04	1.22E+03	1.24E+03	-1.927	
8	4.43E-04	1.07E+03	1.10E+03	-3.422	
9	5.64E-04	9.53E+02	9.72E+02	-1.964	
10	7.13E-04	8.95E+02	8.71E+02	2.776	
11	8.81E-04	8.07E+02	7.97E+02	1.272	

R: 76. X: 0. Y: 76. DL: 152. REQ: 84. CF: 1.0000
CLHZ ARRAY, 11 DATA POINTS, RAMP: 100.0 MICROSEC, DATA: MBL3S2
1002 300N 222NZ OPR H 4 8 -
Ch.21 = 0.1 Ch.22 = 0.089 Ch.23 = 15 Ch.24 = 23
RMS LOG ERROR: 1.31E-02, ANTILOG YIELDS 3.0630 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	T 1
P 1	1.00		
P 2	-0.01	0.95	
T 1	0.01	0.02	0.99


NSL1S1
MODEL:
168.
OHM-M
82.7 M
1.87
OHM-M
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
Blackhawk Geosciences, Incorporated
% ERROR: 3.37
CALIBRATION: 1
OFFSET: 31 M
RAMP: 60.0

NSL1S1

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		54.9	180.0		
167.80	82.7	-27.9	-91.4	0.5	0.5
1.87					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	2.18E+02	2.23E+02	-2.227	
2	1.10E-04	1.74E+02	1.74E+02	0.019	
3	1.40E-04	1.34E+02	1.33E+02	0.913	
4	1.77E-04	1.04E+02	1.02E+02	1.475	
5	2.20E-04	8.20E+01	8.04E+01	1.957	
6	2.80E-04	6.36E+01	6.21E+01	2.481	
7	3.55E-04	4.91E+01	4.87E+01	0.756	
8	4.43E-04	3.91E+01	3.89E+01	0.553	
9	5.64E-04	3.10E+01	3.09E+01	0.354	
10	7.13E-04	2.50E+01	2.49E+01	0.353	
11	8.81E-04	2.07E+01	2.06E+01	0.239	
12	8.90E-04	1.94E+01	2.05E+01	-4.955	
13	1.10E-03	1.73E+01	1.72E+01	0.279	
14	1.10E-03	1.64E+01	1.72E+01	-4.561	
15	1.40E-03	1.37E+01	1.42E+01	-3.296	
16	1.41E-03	1.43E+01	1.41E+01	1.274	
17	1.77E-03	1.17E+01	1.19E+01	-1.782	
18	1.80E-03	1.21E+01	1.18E+01	2.927	
19	2.20E-03	1.02E+01	1.02E+01	-0.418	
20	2.80E-03	8.90E+00	8.71E+00	2.283	
21	3.55E-03	7.77E+00	7.57E+00	2.562	

R: 31. X: 0. Y: 31. DL: 62. REQ: 34. CF: 1.0000
CLHZ ARRAY, 21 DATA POINTS, RAMP: 60.0 MICROSEC, DATA: NSL1S1
1308 NS 100WZ OPR XTL L 4 8 -100
Ch.21 = 0.06 Ch.22 = 0.89 Ch.23 = 20 Ch.24 = 38
RMS LOG ERROR: 1.44E-02, ANTILOG YIELDS 3.3734 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

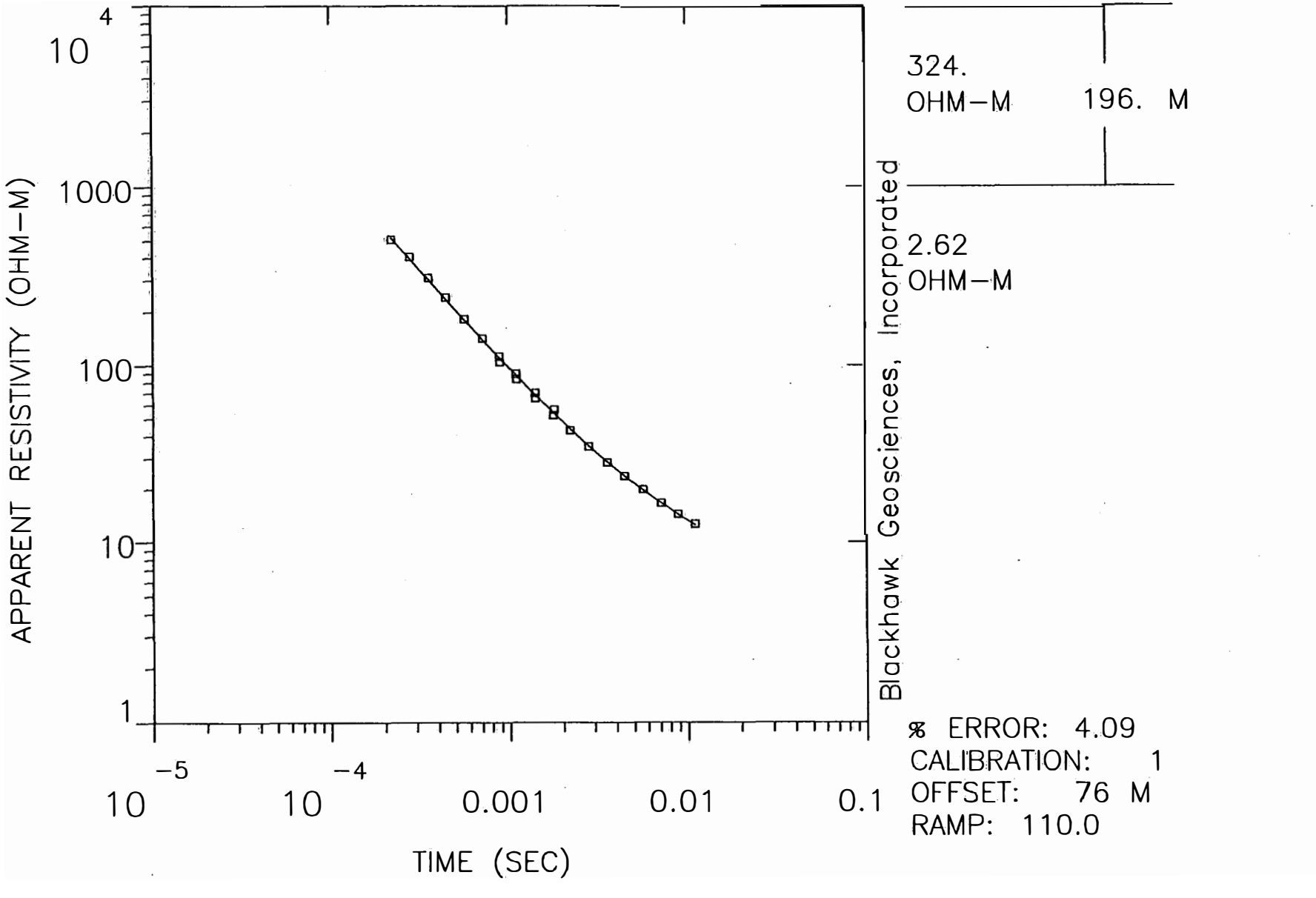
PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.94		
P 2	-0.01	1.00	
T 1	0.00	0.00	1.00
	P 1	P 2	T 1

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	119.197	167.803	391.784
	2	1.731	1.870	2.089

THICK	1	80.434	82.730	83.864
DEPTH	1	80.434	82.730	83.864


NSL1S2
MODEL:
APPARENT RESISTIVITY (OHM-M)
10 4
1000
100
10
1
10 -5
10 -4
0.001
0.01
0.1
TIME (SEC)
324.
OHM-M
196. M
2.62
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 4.09
CALIBRATION: 1
OFFSET: 76 M
RAMP: 110.0

NSL1S2

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		160.9	528.0		
324.29	196.0	-35.1	-115.1	0.6	0.6
2.62					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	2.20E-04	5.07E+02	5.16E+02	-1.846	
2	2.80E-04	4.05E+02	3.98E+02	1.658	
3	3.55E-04	3.09E+02	3.02E+02	2.131	
4	4.43E-04	2.41E+02	2.36E+02	2.066	
5	5.64E-04	1.83E+02	1.80E+02	1.338	
6	7.13E-04	1.42E+02	1.39E+02	1.855	
7	8.81E-04	1.12E+02	1.11E+02	1.636	
8	8.90E-04	1.04E+02	1.09E+02	-4.749	
9	1.10E-03	8.96E+01	8.81E+01	1.670	
10	1.10E-03	8.35E+01	8.78E+01	-4.809	
11	1.40E-03	6.55E+01	6.83E+01	-4.185	
12	1.41E-03	7.00E+01	6.78E+01	3.255	
13	1.77E-03	5.24E+01	5.42E+01	-3.285	
14	1.80E-03	5.66E+01	5.35E+01	5.765	
15	2.20E-03	4.30E+01	4.41E+01	-2.534	
16	2.80E-03	3.49E+01	3.53E+01	-0.944	
17	3.55E-03	2.84E+01	2.87E+01	-1.313	
18	4.43E-03	2.38E+01	2.38E+01	-0.091	
19	5.64E-03	1.99E+01	1.97E+01	0.885	
20	7.13E-03	1.67E+01	1.66E+01	0.481	
21	8.81E-03	1.43E+01	1.43E+01	0.281	
22	1.10E-02	1.26E+01	1.24E+01	1.451	

R: 76. X: 0. Y: 76. DL: 152. REQ: 84. CF: 1.0000
CLHZ ARRAY, 22 DATA POINTS, RAMP: 110.0 MICROSEC, DATA: NSL1S2
1308 NS 200WZ OPR XTL L 5 8 -100 152*152
Ch.21 = 0.11 Ch.22 = 0.89 Ch.23 = 19 Ch.24 = 23
RMS LOG ERROR: 1.74E-02, ANTILOG YIELDS 4.0857 %
LATE TIME PARAMETERS

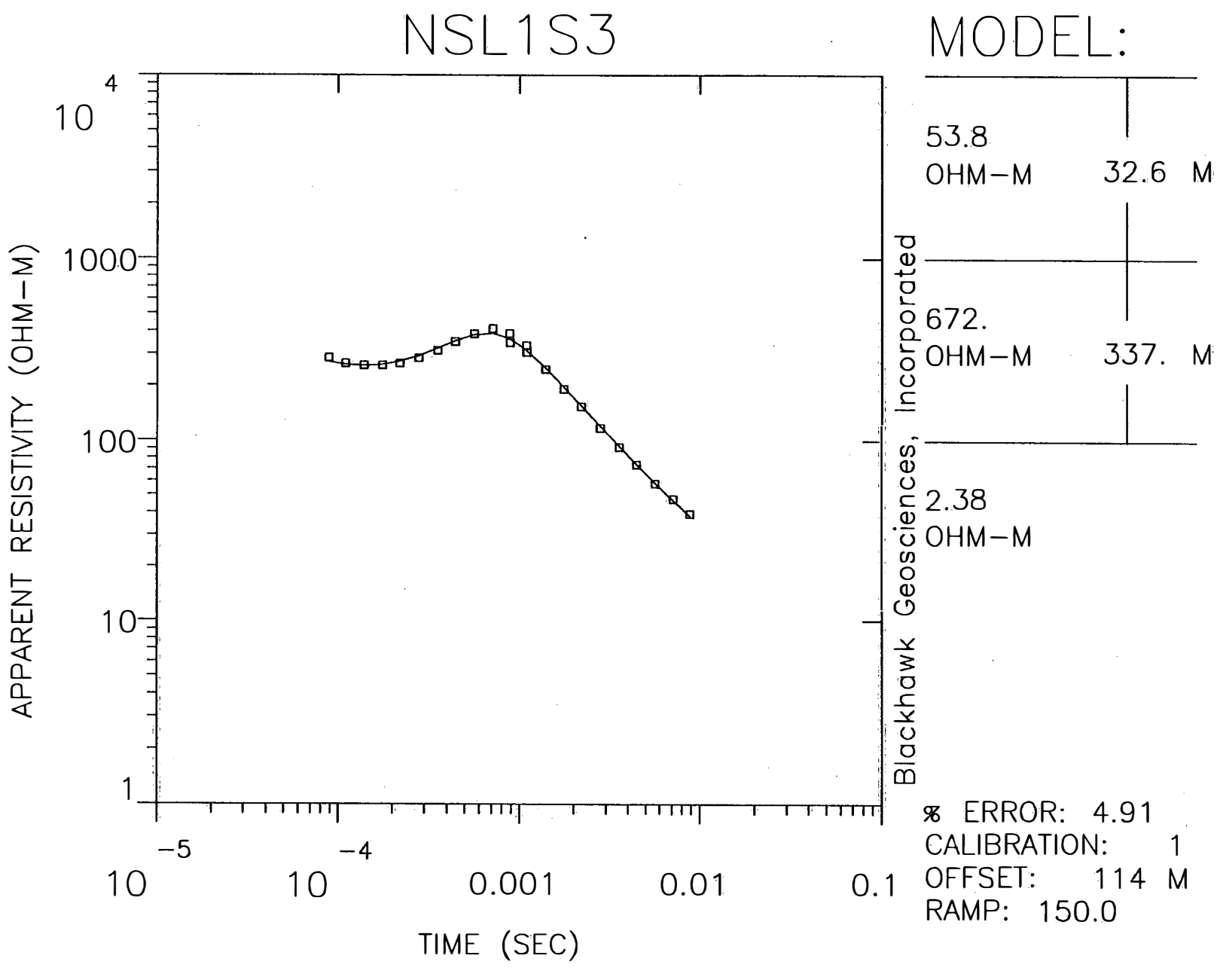
* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.99		
P 2	0.00	1.00	
T 1	0.00	0.00	1.00
	P 1	P 2	T 1

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	265.731	324.291	466.979
	2	2.330	2.622	2.972
THICK	1	192.841	196.031	198.464
DEPTH	1	192.841	196.031	198.464


NSL1S3
MODEL:
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
53.8
OHM-M
32.6 M
672.
OHM-M
337. M
2.38
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 4.91
CALIBRATION: 1
OFFSET: 114 M
RAMP: 150.0

NSL1S3

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		312.1	1024.0		
53.80	32.6	279.5	917.0	0.6	0.6
672.35	336.8	-57.3	-187.9	0.5	1.1
2.38					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	2.84E+02	2.70E+02	5.266	
2	1.10E-04	2.65E+02	2.60E+02	1.909	
3	1.40E-04	2.57E+02	2.56E+02	0.294	
4	1.77E-04	2.57E+02	2.60E+02	-1.383	
5	2.20E-04	2.63E+02	2.71E+02	-2.817	
6	2.80E-04	2.83E+02	2.91E+02	-2.720	
7	3.55E-04	3.11E+02	3.20E+02	-2.789	
8	4.43E-04	3.49E+02	3.51E+02	-0.751	
9	5.64E-04	3.85E+02	3.81E+02	0.860	
10	7.13E-04	4.12E+02	3.87E+02	6.234	
11	8.81E-04	3.86E+02	3.62E+02	6.800	
12	8.90E-04	3.44E+02	3.60E+02	-4.480	
13	1.10E-03	3.32E+02	3.12E+02	6.357	
14	1.10E-03	3.03E+02	3.11E+02	-2.424	
15	1.40E-03	2.46E+02	2.49E+02	-1.221	
16	1.77E-03	1.90E+02	1.95E+02	-2.561	
17	2.20E-03	1.53E+02	1.55E+02	-1.059	
18	2.80E-03	1.17E+02	1.20E+02	-2.334	
19	3.55E-03	9.17E+01	9.34E+01	-1.800	
20	4.43E-03	7.37E+01	7.44E+01	-0.901	
21	5.64E-03	5.78E+01	5.84E+01	-1.054	
22	7.13E-03	4.75E+01	4.65E+01	2.137	
23	8.81E-03	3.93E+01	3.82E+01	2.962	

R: 114. X: 0. Y: 114. DL: 228. REQ: 127. CF: 1.0000
CLHZ ARRAY, 23 DATA POINTS, RAMP: 150.0 MICROSEC, DATA: NSL1S3
1308 NS 300NZ OPR XTL L 6 8 -100 228*228
Ch.21 = 0.15 Ch.22 = 0.89 Ch.23 = 18 Ch.24 = 51
RMS LOG ERROR: 2.08E-02, ANTILOG YIELDS 4.9122 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

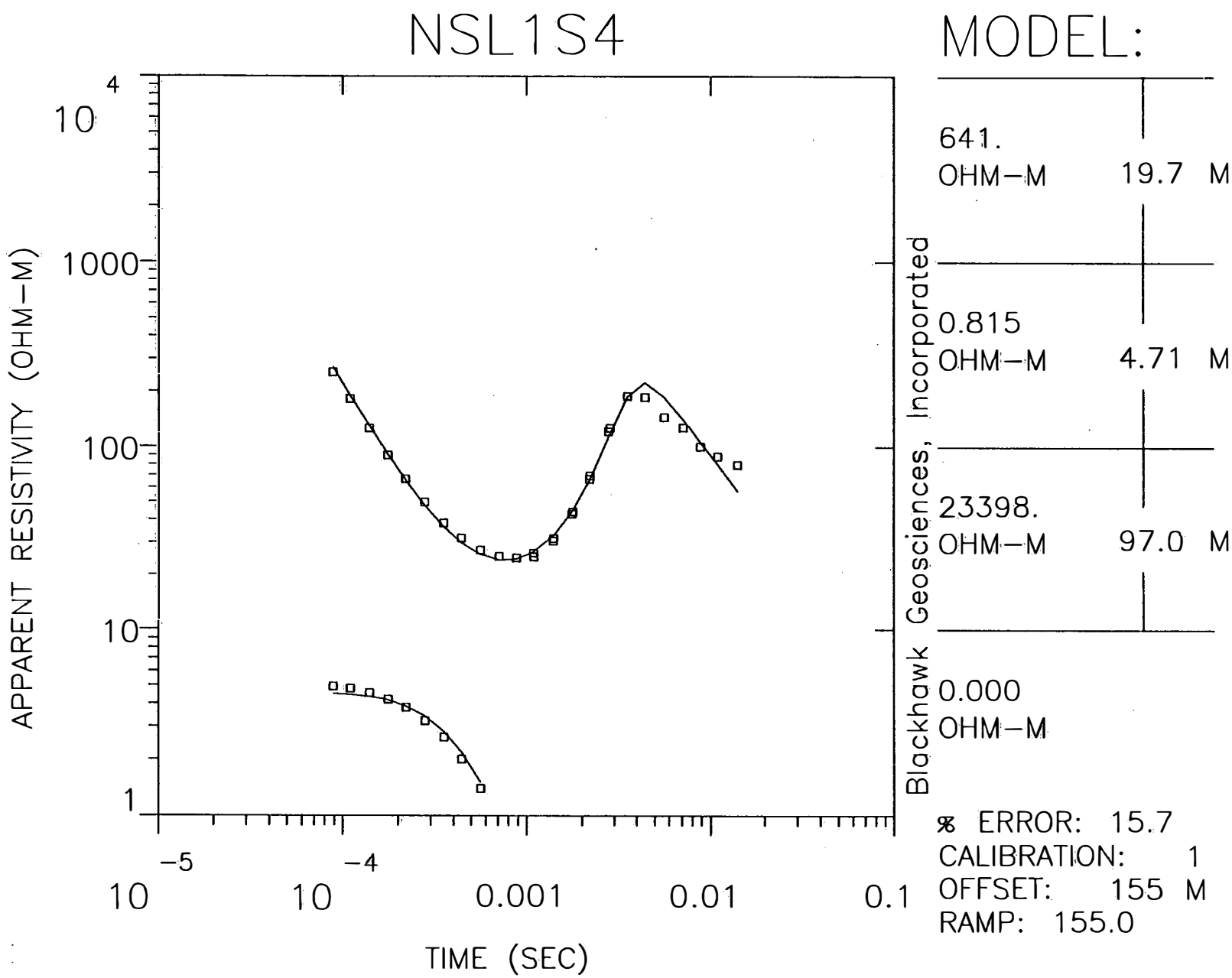
PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.81				
P 2	-0.15	0.33			
P 3	0.08	-0.07	0.72		
T 1	-0.26	-0.31	0.09	0.62	
T 2	0.03	0.03	-0.02	0.04	0.99

P 1 P 2 P 3 T 1 T 2

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	40.340	53.799	77.589
	2	534.819	672.351	1039.174
	3	1.686	2.377	2.822
THICK	1	22.055	32.607	55.758
	2	311.711	336.787	351.236
DEPTH	1	22.055	32.607	55.758
	2	364.542	369.394	374.821


NSL1S4
MODEL:
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
Blackhawk Geosciences, Incorporated
641.
OHM-M
19.7 M
0.815
OHM-M
4.71 M
23398.
OHM-M
97.0 M
0.000
OHM-M
% ERROR: 15.7
CALIBRATION: 1
OFFSET: 155 M
RAMP: 155.0

NSL1S4

MODEL: 4 LAYERS

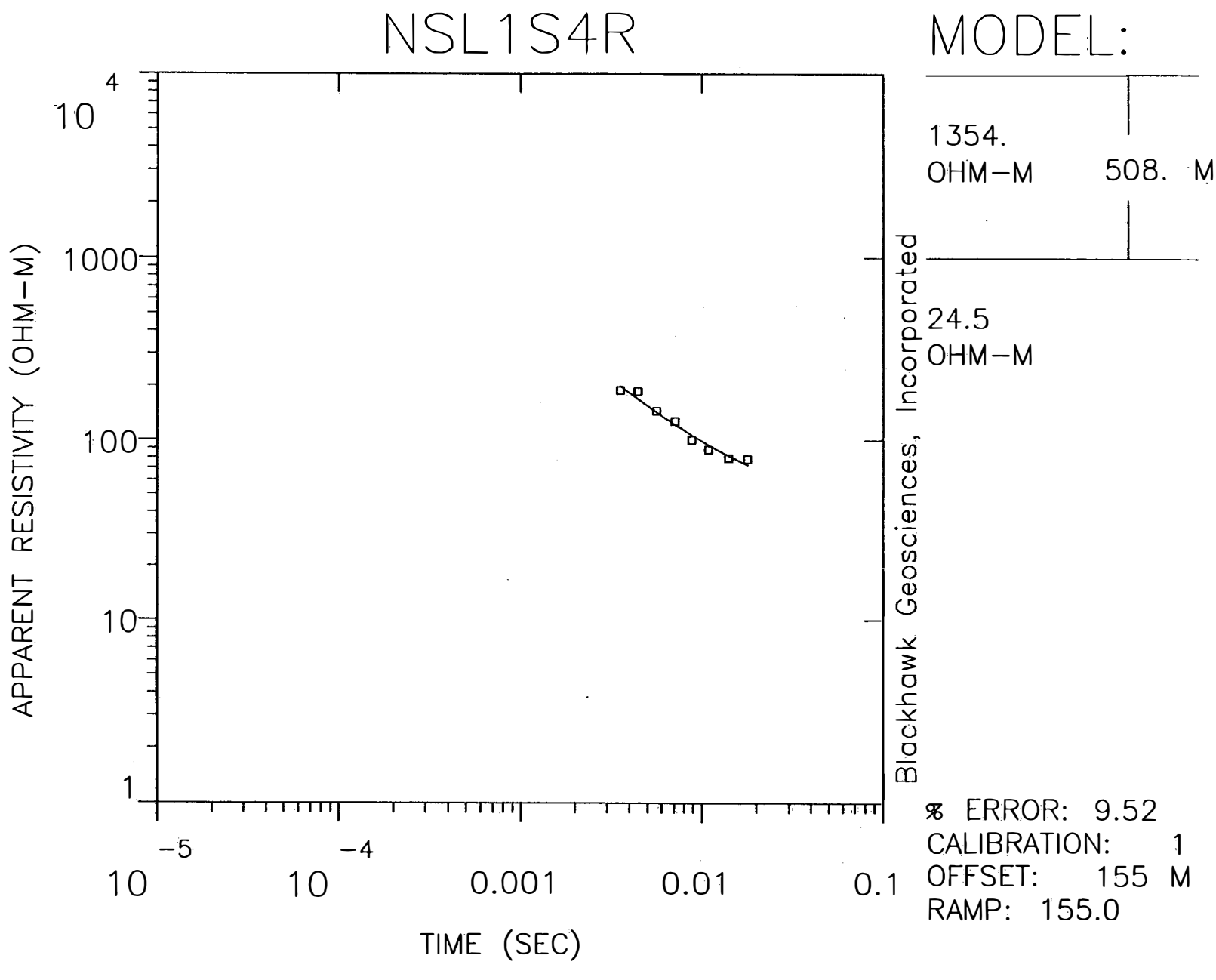
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		405.1	1329.0		
640.55	19.7	385.4	1264.5	0.0	0.0
0.81	4.7	380.7	1249.0	5.8	5.8
23397.60	97.0	283.7	930.7	0.0	5.8
0.00					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	2.53E+02	2.69E+02	-5.918	
2	1.10E-04	1.81E+02	1.90E+02	-4.891	
3	1.40E-04	1.26E+02	1.29E+02	-2.807	
4	1.77E-04	8.98E+01	9.03E+01	-0.623	
5	2.20E-04	6.68E+01	6.59E+01	1.324	
6	2.80E-04	4.99E+01	4.80E+01	3.936	
7	3.55E-04	3.84E+01	3.67E+01	4.710	
8	4.43E-04	3.17E+01	3.00E+01	5.881	
9	5.64E-04	2.72E+01	2.58E+01	5.586	
10	7.13E-04	2.51E+01	2.40E+01	4.527	
11	8.81E-04	2.47E+01	2.43E+01	1.452	
12	8.90E-04	2.46E+01	2.44E+01	0.848	
13	1.10E-03	2.63E+01	2.67E+01	-1.529	
14	1.10E-03	2.50E+01	2.67E+01	-6.393	
15	1.40E-03	3.05E+01	3.28E+01	-6.821	
16	1.41E-03	3.16E+01	3.31E+01	-4.473	
17	1.77E-03	4.31E+01	4.46E+01	-3.516	
18	1.80E-03	4.41E+01	4.56E+01	-3.298	
19	2.20E-03	6.68E+01	6.59E+01	1.401	
20	2.22E-03	6.94E+01	6.73E+01	3.069	
21	2.80E-03	1.21E+02	1.12E+02	7.572	
22	2.85E-03	1.26E+02	1.17E+02	7.606	
23	3.55E-03	1.89E+02	1.87E+02	1.135	
24	4.43E-03	1.86E+02	2.22E+02	-16.398	
25	5.64E-03	1.44E+02	1.86E+02	-22.567	
26	7.13E-03	1.27E+02	1.40E+02	-8.902	
27	8.81E-03	9.99E+01	1.06E+02	-5.901	
28	1.10E-02	8.83E+01	7.98E+01	10.627	
29	1.41E-02	7.95E+01	5.72E+01	38.910	

R: 155. X: 0. Y: 155. DL: 310. REQ: 172. CF: 1.0000
CLHZ ARRAY, 29 DATA POINTS, RAMP: 155.0 MICROSEC, DATA: NSL1S4
1608 NS 900WZ OPR XTL L 6 8 -100
Ch.21 = 0.15 Ch.22 = 0.89 Ch.23 = 13 Ch.24 = 96
RMS LOG ERROR: 6.33E-02, ANTILOG YIELDS 15.6801 %
LATE TIME PARAMETERS

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.00						
P 2	0.00	0.53					
P 3	0.00	0.00	0.00				
P 4	0.00	-0.02	0.00	0.06			
T 1	0.00	0.08	0.00	-0.04	0.12		
T 2	0.00	-0.41	0.00	0.06	-0.03	0.51	
T 3	0.00	-0.09	0.00	-0.14	0.08	0.08	0.66
	P 1	P 2	P 3	P 4	T 1	T 2	T 3


NSL1S4R
MODEL:
1354.
OHM-M
508. M
24.5
OHM-M
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
Blackhawk Geosciences, Incorporated
% ERROR: 9.52
CALIBRATION: 1
OFFSET: 155 M
RAMP: 155.0

NSL1S4R

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		405.1	1329.0		
1353.99	508.2	-103.1	-338.2	0.4	0.4
24.55					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	3.55E-03	1.89E+02	2.00E+02	-5.625	
2	4.43E-03	1.86E+02	1.69E+02	9.939	
3	5.64E-03	1.44E+02	1.42E+02	1.344	
4	7.13E-03	1.27E+02	1.22E+02	4.517	
5	8.81E-03	9.99E+01	1.07E+02	-6.329	
6	1.10E-02	8.83E+01	9.39E+01	-6.042	
7	1.41E-02	7.95E+01	8.20E+01	-3.022	
8	1.80E-02	7.86E+01	7.28E+01	7.961	

R: 155. X: 0. Y: 155. DL: 310. REQ: 172. CF: 1.0000
CLHZ ARRAY, 8 DATA POINTS, RAMP: 155.0 MICROSEC, DATA: NSL1S4R
1608 NS 900WZ OPR XTL H 3 8 -100
Ch.21 = 0.15 Ch.22 = 0.089 Ch.23 = 13 Ch.24 = 9
RMS LOG ERROR: 3.95E-02, ANTILOG YIELDS 9.5246 %
LATE TIME PARAMETERS

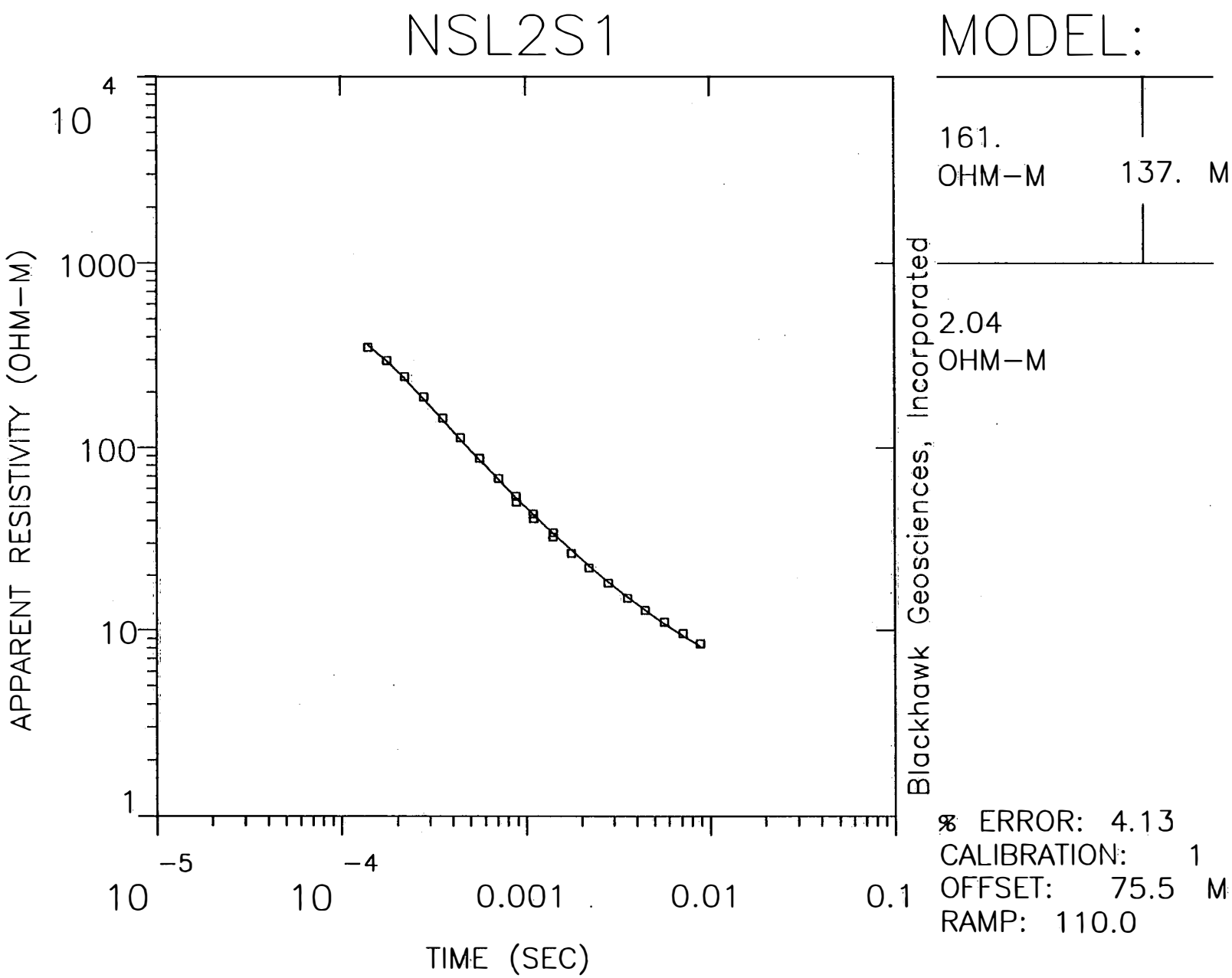
* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	T 1
P 1	0.12		
P 2	-0.02	1.00	
T 1	0.04	0.00	1.00

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	330.612	1353.992	7152.583
	2	22.683	24.550	26.990
THICK	1	469.091	508.154	543.218
DEPTH	1	469.091	508.154	543.218


NSL2S1
MODEL:
161.
OHM-M
137. M
2.04
OHM-M
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
Blackhawk Geosciences, Incorporated
% ERROR: 4.13
CALIBRATION: 1
OFFSET: 75.5 M
RAMP: 110.0

NSL2S1

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		118.0	387.0		
161.20	136.7	-18.7	-61.5	0.8	0.8
2.04					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	1.40E-04	3.51E+02	3.59E+02	-2.418	
2	1.77E-04	2.97E+02	2.94E+02	0.877	
3	2.20E-04	2.42E+02	2.37E+02	2.146	
4	2.80E-04	1.89E+02	1.83E+02	2.957	
5	3.55E-04	1.44E+02	1.41E+02	2.059	
6	4.43E-04	1.13E+02	1.11E+02	2.280	
7	5.64E-04	8.72E+01	8.55E+01	2.030	
8	7.13E-04	6.80E+01	6.67E+01	1.997	
9	8.81E-04	5.44E+01	5.36E+01	1.461	
10	8.90E-04	5.07E+01	5.31E+01	-4.456	
11	1.10E-03	4.37E+01	4.31E+01	1.422	
12	1.10E-03	4.10E+01	4.30E+01	-4.505	
13	1.40E-03	3.25E+01	3.40E+01	-4.426	
14	1.41E-03	3.44E+01	3.38E+01	1.794	
15	1.77E-03	2.63E+01	2.74E+01	-3.887	
16	2.20E-03	2.19E+01	2.26E+01	-3.009	
17	2.80E-03	1.81E+01	1.84E+01	-1.791	
18	3.55E-03	1.50E+01	1.52E+01	-1.600	
19	4.43E-03	1.29E+01	1.29E+01	-0.097	
20	5.64E-03	1.11E+01	1.09E+01	1.691	
21	7.13E-03	9.61E+00	9.33E+00	3.013	
22	8.81E-03	8.47E+00	8.20E+00	3.382	

R: 75. X: 0. Y: 76. DL: 151. REQ: 84. CF: 1.0000
CLHZ ARRAY, 22 DATA POINTS, RAMP: 110.0 MICROSEC, DATA: NSL2S1
1408 NS 400WZ OPR XTL L 5 8 -100
Ch.21 = 0.11 Ch.22 = 0.89 Ch.23 = 18.5 Ch.24 =
RMS LOG ERROR: 1.76E-02, ANTILOG YIELDS 4.1326 %
LATE TIME PARAMETERS

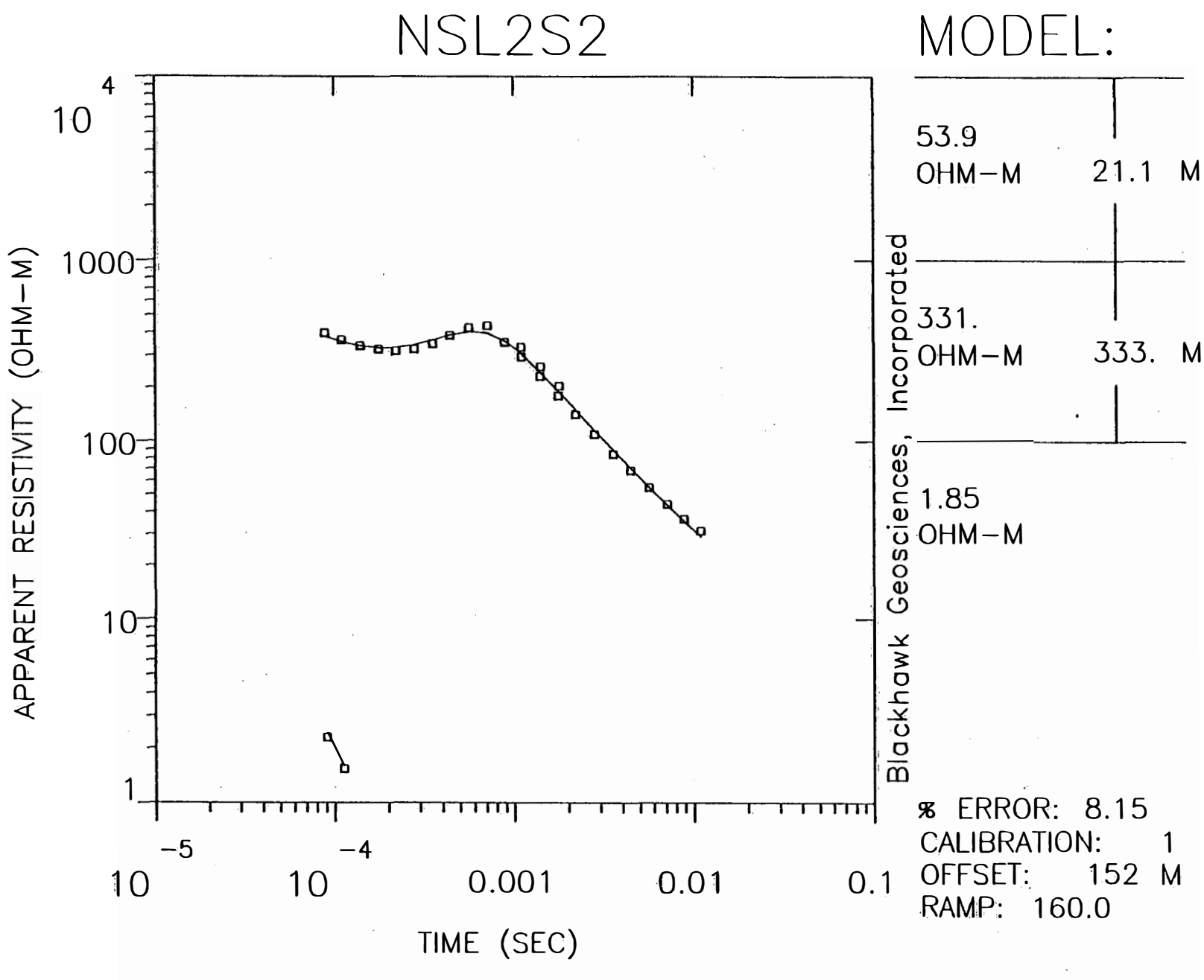
* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.94		
P 2	-0.03	0.95	
T 1	0.00	0.00	1.00
	P 1	P 2	T 1

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

LAYER		MINIMUM	BEST	MAXIMUM
RHO	1	144.736	161.200	189.572
	2	1.811	2.037	2.276
THICK	1	134.772	136.694	138.557
DEPTH	1	134.772	136.694	138.557


NSL2S2
MODEL:
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
53.9
OHM-M
21.1 M
331.
OHM-M
333. M
1.85
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 8.15
CALIBRATION: 1
OFFSET: 152 M
RAMP: 160.0

NSL2S2

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		324.9	1066.0		
53.87	21.1	303.9	996.9	0.4	0.4
330.80	333.0	-29.2	-95.7	1.0	1.4
1.85					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	3.97E+02	3.80E+02	4.410	
2	1.10E-04	3.63E+02	3.55E+02	2.215	
3	1.40E-04	3.38E+02	3.37E+02	0.529	
4	1.77E-04	3.23E+02	3.29E+02	-1.944	
5	2.20E-04	3.16E+02	3.30E+02	-4.429	
6	2.80E-04	3.24E+02	3.42E+02	-5.229	
7	3.55E-04	3.46E+02	3.62E+02	-4.405	
8	4.43E-04	3.85E+02	3.84E+02	0.150	
9	5.64E-04	4.25E+02	4.02E+02	5.663	
10	7.13E-04	4.35E+02	3.95E+02	10.119	
11	8.90E-04	3.52E+02	3.58E+02	-1.809	
12	1.10E-03	3.31E+02	3.06E+02	8.266	
13	1.10E-03	2.92E+02	3.05E+02	-4.246	
14	1.40E-03	2.29E+02	2.42E+02	-5.385	
15	1.41E-03	2.59E+02	2.40E+02	7.619	
16	1.77E-03	1.78E+02	1.89E+02	-5.878	
17	1.80E-03	2.02E+02	1.86E+02	8.667	
18	2.20E-03	1.40E+02	1.49E+02	-6.310	
19	2.80E-03	1.09E+02	1.15E+02	-4.928	
20	3.55E-03	8.43E+01	8.92E+01	-5.502	
21	4.43E-03	6.82E+01	7.06E+01	-3.418	
22	5.64E-03	5.49E+01	5.51E+01	-0.282	
23	7.13E-03	4.42E+01	4.36E+01	1.480	
24	8.81E-03	3.66E+01	3.55E+01	3.023	
25	1.10E-02	3.13E+01	2.89E+01	8.269	

R: 152. X: 0. Y: 152. DL: 304. REQ: 169. CF: 1.0000
CLHZ ARRAY, 25 DATA POINTS, RAMP: 160.0 MICROSEC, DATA: NSL2S2
1408 NS 500WZ OPR XTL L 6 8 -100
Ch.21 = 0.165 Ch.22 = 0.89 Ch.23 = 14.5 Ch.24 =
RMS LOG ERROR: 3.40E-02, ANTILOG YIELDS 8.1524 %
LATE TIME PARAMETERS

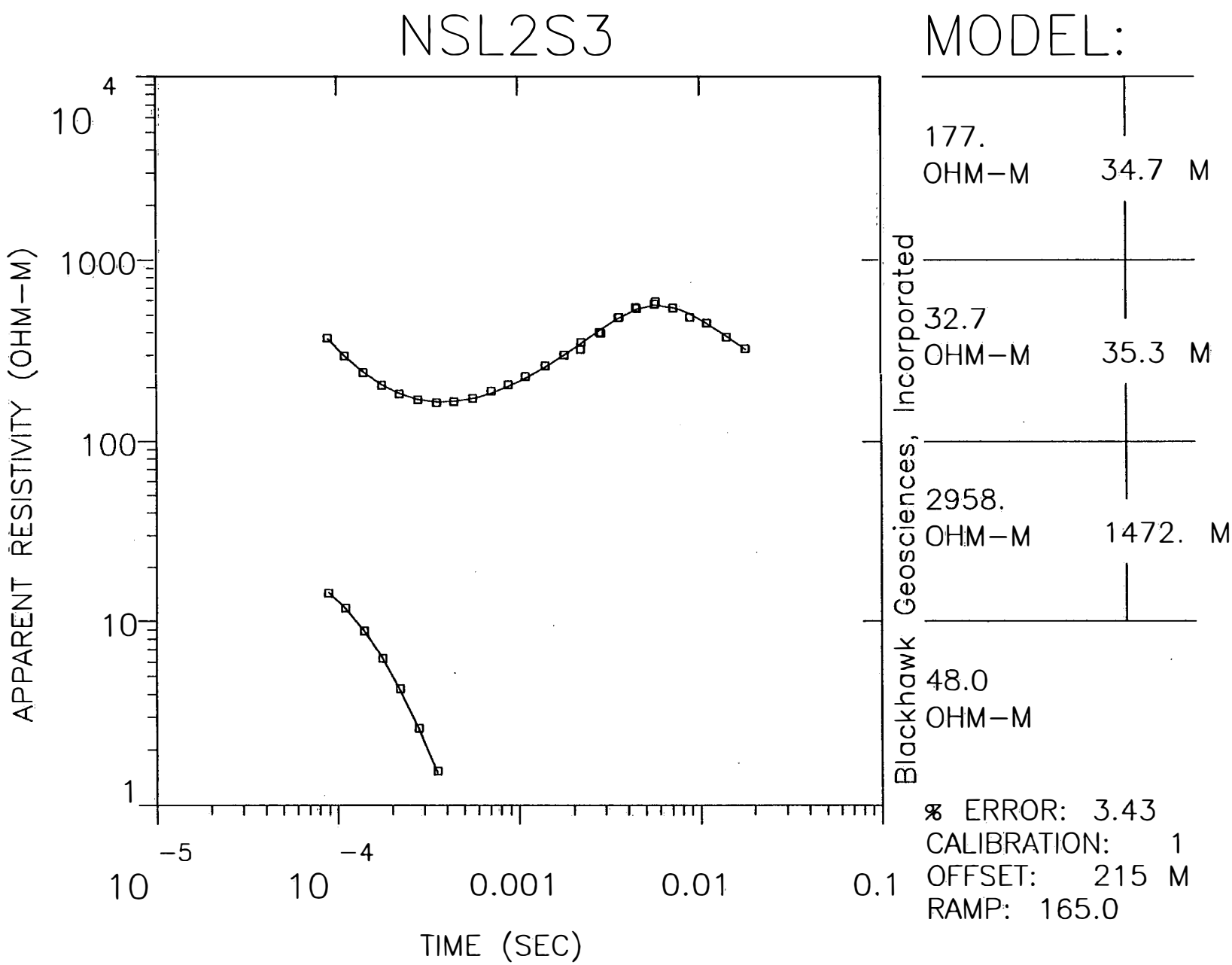
* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER
P 1 0.43
P 2 0.24 0.34
P 3 -0.01 -0.08 0.11

```
T 1 -0.35 -0.23  0.01  0.30
T 2  0.02  0.02 -0.05  0.05  0.97
       P 1   P 2   P 3   T 1   T 2
```

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	38.500	53.872	75.294
	2	265.339	330.799	452.795
	3	1.140	1.847	2.994
THICK	1	10.749	21.056	36.847
	2	320.224	333.041	349.122
DEPTH	1	10.749	21.056	36.847
	2	344.577	354.097	364.049


NSL2S3
MODEL:
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
177.
OHM-M
34.7 M
32.7
OHM-M
35.3 M
2958.
OHM-M
1472. M
48.0
OHM-M
% ERROR: 3.43
CALIBRATION: 1
OFFSET: 215 M
RAMP: 165.0
Blackhawk Geosciences, Incorporated

NSL2S3

MODEL: 4 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	(FEET)	CONDUCTANCE (S) LAYER	TOTAL
		555.0	1821.0		
177.48	34.7	520.3	1707.0	0.2	0.2
32.73	35.3	485.0	1591.1	1.1	1.3
2957.67	1471.7	-986.7	-3237.2	0.5	1.8
48.02					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	3.72E+02	3.69E+02	0.825	
2	1.10E-04	2.97E+02	2.97E+02	-0.077	
3	1.40E-04	2.41E+02	2.41E+02	-0.291	
4	1.77E-04	2.05E+02	2.06E+02	-0.601	
5	2.20E-04	1.83E+02	1.85E+02	-0.970	
6	2.80E-04	1.71E+02	1.72E+02	-0.653	
7	3.55E-04	1.64E+02	1.66E+02	-1.323	
8	4.43E-04	1.66E+02	1.67E+02	-0.456	
9	5.64E-04	1.74E+02	1.73E+02	0.205	
10	7.13E-04	1.90E+02	1.86E+02	2.459	
11	8.81E-04	2.07E+02	2.02E+02	2.493	
12	1.10E-03	2.30E+02	2.24E+02	2.445	
13	1.41E-03	2.62E+02	2.58E+02	1.604	
14	1.80E-03	3.00E+02	3.01E+02	-0.121	
15	2.20E-03	3.24E+02	3.46E+02	-6.324	
16	2.22E-03	3.53E+02	3.48E+02	1.432	
17	2.80E-03	4.00E+02	4.09E+02	-2.079	
18	2.85E-03	3.96E+02	4.14E+02	-4.398	
19	3.55E-03	4.83E+02	4.77E+02	1.111	
20	3.60E-03	4.84E+02	4.82E+02	0.558	
21	4.43E-03	5.48E+02	5.34E+02	2.619	
22	4.49E-03	5.43E+02	5.37E+02	0.977	
23	5.64E-03	5.72E+02	5.64E+02	1.310	
24	5.70E-03	5.91E+02	5.65E+02	4.626	
25	7.13E-03	5.44E+02	5.48E+02	-0.694	
26	8.81E-03	4.85E+02	5.06E+02	-4.281	
27	1.10E-02	4.50E+02	4.46E+02	0.702	
28	1.41E-02	3.78E+02	3.80E+02	-0.452	
29	1.80E-02	3.26E+02	3.23E+02	0.921	

R: 215. X: 0. Y: 215. DL: 430. REQ: 239. CF: 1.0000
CLHZ ARRAY, 29 DATA POINTS, RAMP: 165.0 MICROSEC, DATA: NSL2S3
1408 NS 600WZ OPR XTL L 5 8 -1000
Ch.21 = 0.165 Ch.22 = 0.89 Ch.23 = 11.5 Ch.24 =
RMS LOG ERROR: 1.47E-02, ANTILOG YIELDS 3.4312 %
LATE TIME PARAMETERS

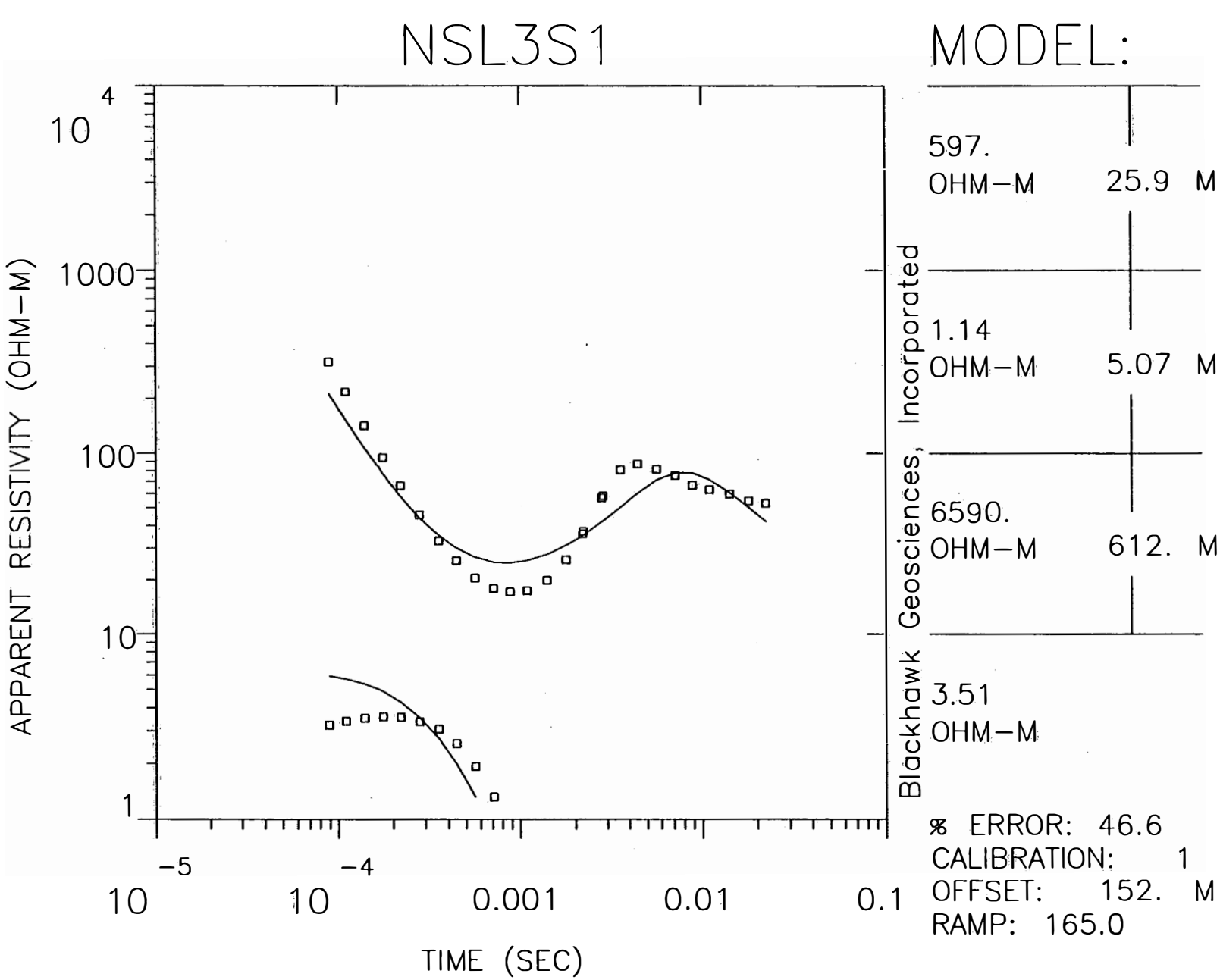
* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.12						
P 2	0.13	0.71					
P 3	0.05	-0.11	0.29				
P 4	-0.05	0.10	-0.15	0.48			
T 1	0.18	0.19	-0.04	-0.07	0.68		
T 2	-0.06	-0.32	-0.16	0.11	0.27	0.61	
T 3	0.00	-0.01	0.03	0.04	0.01	-0.01	0.99
	P 1	P 2	P 3	P 4	T 1	T 2	T 3

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	131.632	177.479	238.888
	2	25.542	32.727	49.197
	3	2109.036	2957.667	4412.429
	4	30.963	48.018	69.035
THICK	1	24.629	34.742	42.321
	2	27.068	35.334	58.340
	3	1419.868	1471.662	1531.644
DEPTH	1	24.629	34.742	42.321
	2	66.917	70.076	82.969
	3	1490.213	1541.738	1601.703


NSL3S1
MODEL:
APPARENT RESISTIVITY (OHM-M)
10 4
1000
100
10
1
10 -5
10 -4
0.001
0.01
0.1
TIME (SEC)
597.
OHM-M
25.9 M
1.14
OHM-M
5.07 M
6590.
OHM-M
612. M
3.51
OHM-M
% ERROR: 46.6
CALIBRATION: 1
OFFSET: 152. M
RAMP: 165.0
Blackhawk Geosciences, Incorporated

NSL3S1

MODEL: 4 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		366.1	1201.0		
596.50	25.9	340.2	1116.1	0.0	0.0
1.14	5.1	335.1	1099.5	4.4	4.5
6589.51	612.5	-277.3	-909.9	0.1	4.6
3.51					

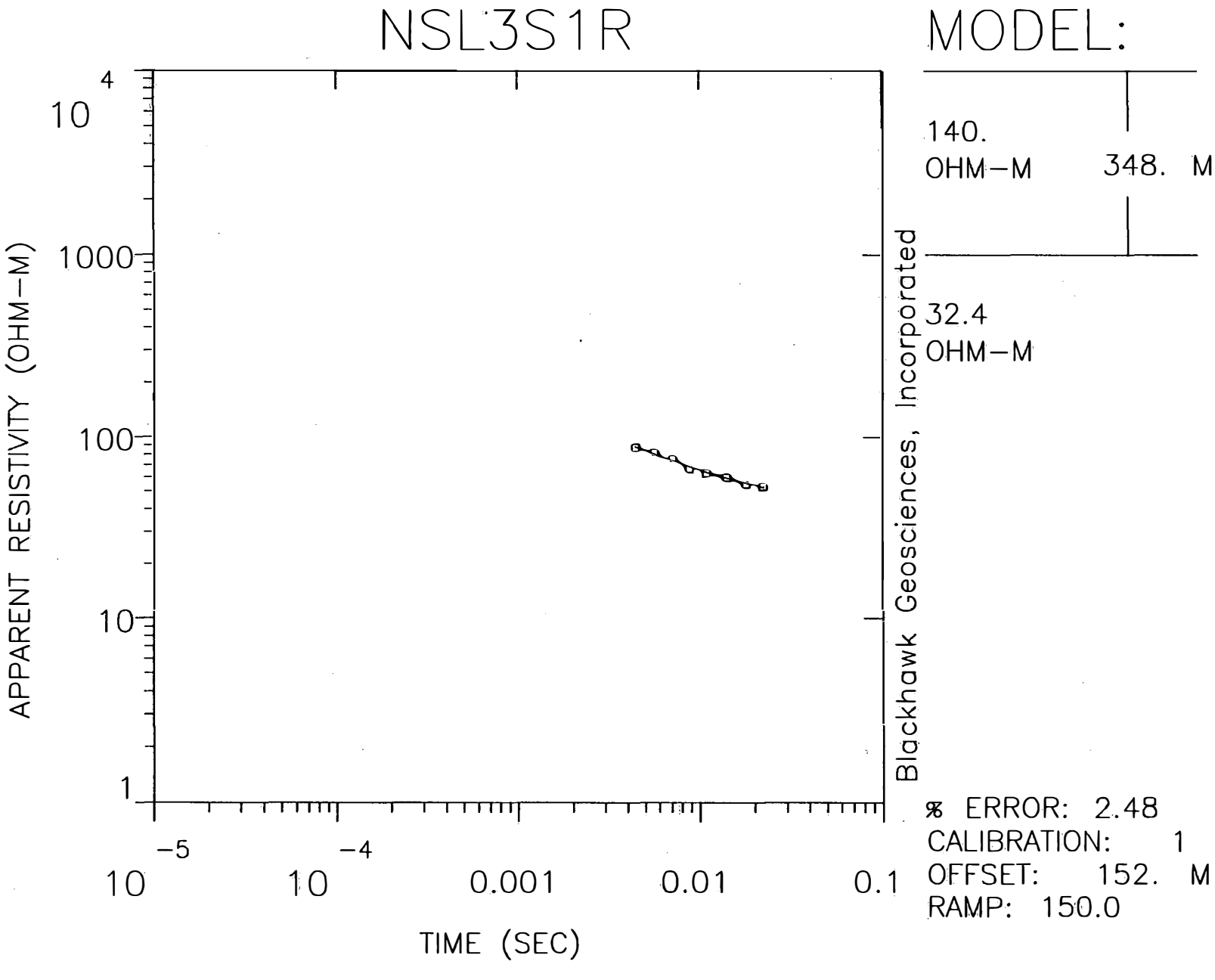
	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	3.19E+02	2.13E+02	49.860	
2	1.10E-04	2.17E+02	1.53E+02	41.560	
3	1.40E-04	1.42E+02	1.07E+02	32.483	
4	1.77E-04	9.47E+01	7.70E+01	22.899	
5	2.20E-04	6.61E+01	5.83E+01	13.483	
6	2.80E-04	4.59E+01	4.43E+01	3.524	
7	3.55E-04	3.29E+01	3.54E+01	-7.195	
8	4.43E-04	2.56E+01	3.01E+01	-15.213	
9	5.64E-04	2.06E+01	2.67E+01	-22.793	
10	7.13E-04	1.81E+01	2.51E+01	-28.026	
11	8.81E-04	1.70E+01	2.48E+01	-31.490	
12	1.10E-03	1.74E+01	2.56E+01	-32.206	
13	1.41E-03	1.99E+01	2.78E+01	-28.517	
14	1.80E-03	2.59E+01	3.12E+01	-16.990	
15	2.20E-03	3.62E+01	3.53E+01	2.409	
16	2.22E-03	3.72E+01	3.56E+01	4.564	
17	2.80E-03	5.69E+01	4.19E+01	35.820	
18	2.85E-03	5.81E+01	4.25E+01	36.799	
19	3.55E-03	8.11E+01	5.05E+01	60.688	
20	4.43E-03	8.76E+01	6.03E+01	45.400	
21	5.64E-03	8.17E+01	7.12E+01	14.756	
22	7.13E-03	7.53E+01	7.82E+01	-3.762	
23	8.81E-03	6.66E+01	7.81E+01	-14.792	
24	1.10E-02	6.30E+01	7.18E+01	-12.228	
25	1.41E-02	5.99E+01	6.07E+01	-1.402	
26	1.80E-02	5.49E+01	5.03E+01	9.065	
27	2.22E-02	5.32E+01	4.23E+01	25.694	

R: 152. X: 0. Y: 153. DL: 305. REQ: 170. CF: 1.0000
CLHZ ARRAY, 27 DATA POINTS, RAMP: 165.0 MICROSEC, DATA: NSL3S1
1508 NS 700WZ OPR XTL H 2 8 -100
Ch.21 = 0.15 Ch.22 = 0.089 Ch.23 = 14.5 Ch.24 =
RMS LOG ERROR: 1.66E-01, ANTILOG YIELDS 46.5878 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.01						
P 2	0.00	0.78					
P 3	0.01	-0.02	0.01				
P 4	0.01	0.22	-0.01	0.31			
T 1	0.02	0.09	0.00	-0.07	0.95		
T 2	-0.01	-0.22	-0.03	0.23	0.09	0.77	
T 3	0.00	0.00	0.00	-0.02	0.00	0.00	1.00
	P 1	P 2	P 3	P 4	T 1	T 2	T 3


NSL3S1R
MODEL:
140.
OHM-M
348. M
32.4
OHM-M
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
Blackhawk Geosciences, Incorporated
% ERROR: 2.48
CALIBRATION: 1
OFFSET: 152. M
RAMP: 150.0

NSL3S1R

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		366.1	1201.0		
139.63	347.6	18.5	60.7	2.5	2.5
32.42					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	4.43E-03	8.76E+01	8.85E+01	-0.965	
2	5.64E-03	8.17E+01	8.03E+01	1.745	
3	7.13E-03	7.53E+01	7.36E+01	2.270	
4	8.81E-03	6.66E+01	6.84E+01	-2.698	
5	1.10E-02	6.30E+01	6.38E+01	-1.230	
6	1.41E-02	5.99E+01	5.92E+01	1.169	
7	1.80E-02	5.49E+01	5.55E+01	-1.141	
8	2.22E-02	5.32E+01	5.27E+01	0.876	

R: 152. X: 0. Y: 153. DL: 305. REQ: 170. CF: 1.0000
CLHZ ARRAY, 8 DATA POINTS, RAMP: 150.0 MICROSEC, DATA: NSL3S1R
1508 NS 700WZ OPR XTL H 2 8 -100
Ch.21 = 0.15 Ch.22 = 0.089 Ch.23 = 14.5 Ch.24 =
RMS LOG ERROR: 1.07E-02, ANTILOG YIELDS 2.4841 %
LATE TIME PARAMETERS

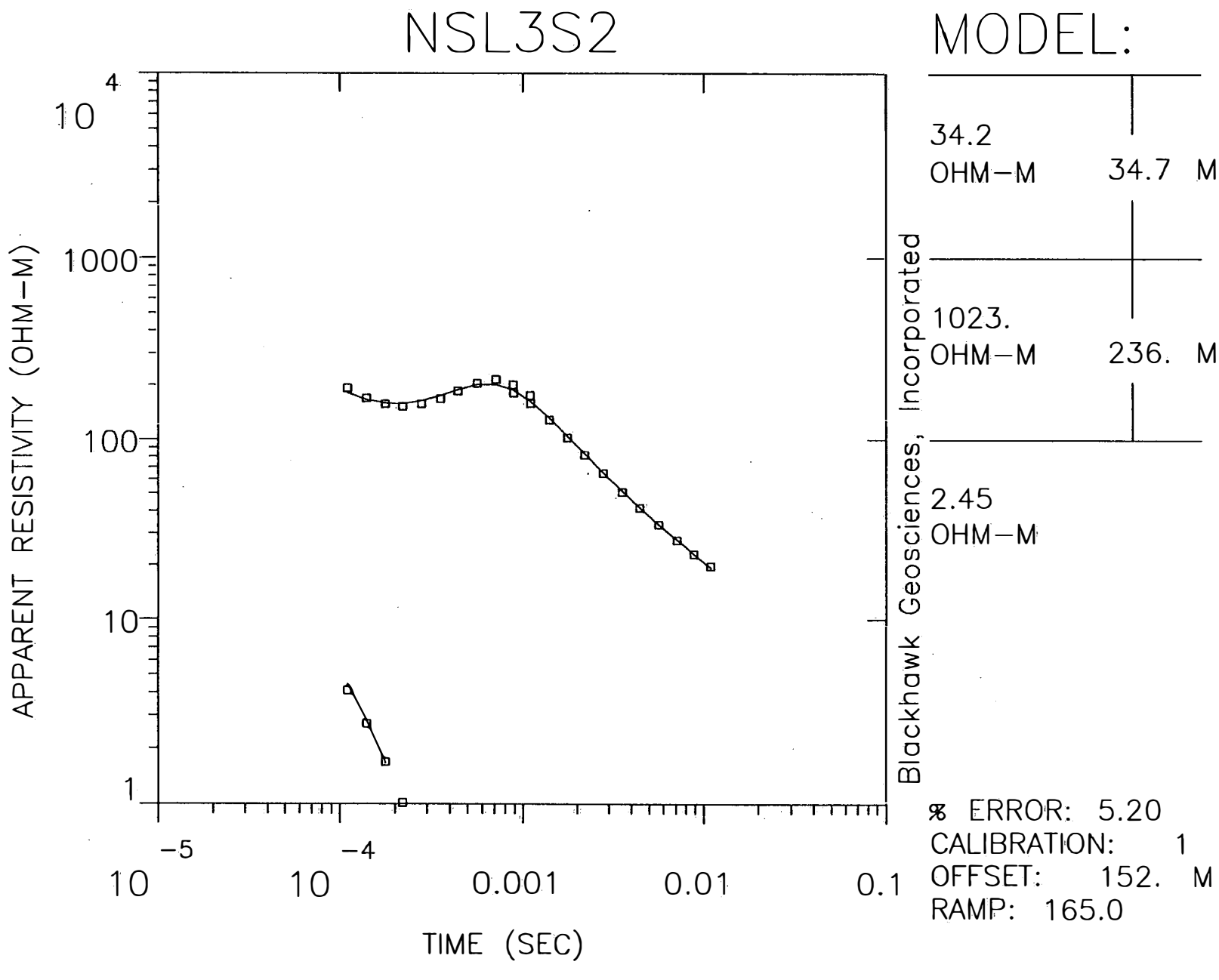
* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.96		
P 2	-0.01	1.00	
T 1	0.02	0.00	0.99
	P 1	P 2	T 1

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	103.601	139.626	175.638
	2	30.517	32.422	33.967
THICK	1	306.952	347.559	408.512
DEPTH	1	306.952	347.559	408.512


NSL3S2
MODEL:
APPARENT RESISTIVITY (OHM-M)
10 4
1000
100
10
1
10 -5
10 -4
0.001
0.01
0.1
TIME (SEC)
34.2
OHM-M
34.7 M
1023.
OHM-M
236. M
2.45
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 5.20
CALIBRATION: 1
OFFSET: 152. M
RAMP: 165.0

NSL3S2

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		245.1	804.0		
34.17	34.7	210.3	690.0	1.0	1.0
1023.38	236.3	-26.0	-85.4	0.2	1.2
2.45					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	1.10E-04	1.92E+02	1.81E+02	5.723	
2	1.40E-04	1.69E+02	1.65E+02	2.318	
3	1.77E-04	1.56E+02	1.58E+02	-0.965	
4	2.20E-04	1.52E+02	1.57E+02	-3.267	
5	2.80E-04	1.57E+02	1.63E+02	-3.895	
6	3.55E-04	1.68E+02	1.74E+02	-3.820	
7	4.43E-04	1.85E+02	1.88E+02	-1.231	
8	5.64E-04	2.04E+02	2.00E+02	1.967	
9	7.13E-04	2.14E+02	2.01E+02	6.350	
10	8.81E-04	2.00E+02	1.87E+02	6.927	
11	8.90E-04	1.80E+02	1.86E+02	-3.183	
12	1.10E-03	1.75E+02	1.62E+02	7.703	
13	1.10E-03	1.58E+02	1.62E+02	-2.282	
14	1.40E-03	1.28E+02	1.31E+02	-2.318	
15	1.77E-03	1.02E+02	1.04E+02	-1.953	
16	2.20E-03	8.16E+01	8.32E+01	-1.966	
17	2.80E-03	6.45E+01	6.54E+01	-1.246	
18	3.55E-03	5.09E+01	5.18E+01	-1.815	
19	4.43E-03	4.14E+01	4.20E+01	-1.323	
20	5.64E-03	3.35E+01	3.36E+01	-0.584	
21	7.13E-03	2.74E+01	2.74E+01	0.096	
22	8.81E-03	2.29E+01	2.29E+01	-0.014	
23	1.10E-02	1.96E+01	1.93E+01	1.974	

R: 152. X: 0. Y: 153. DL: 305. REQ: 170. CF: 1.0000
CLHZ ARRAY, 23 DATA POINTS, RAMP: 165.0 MICROSEC, DATA: NSL3S2
1508 NS 800WZ OPR XTL H 3 8 -100
Ch.21 = 0.16 Ch.22 = 0.089 Ch.23 = 14 Ch.24 = 9
RMS LOG ERROR: 2.20E-02, ANTILOG YIELDS 5.1960 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

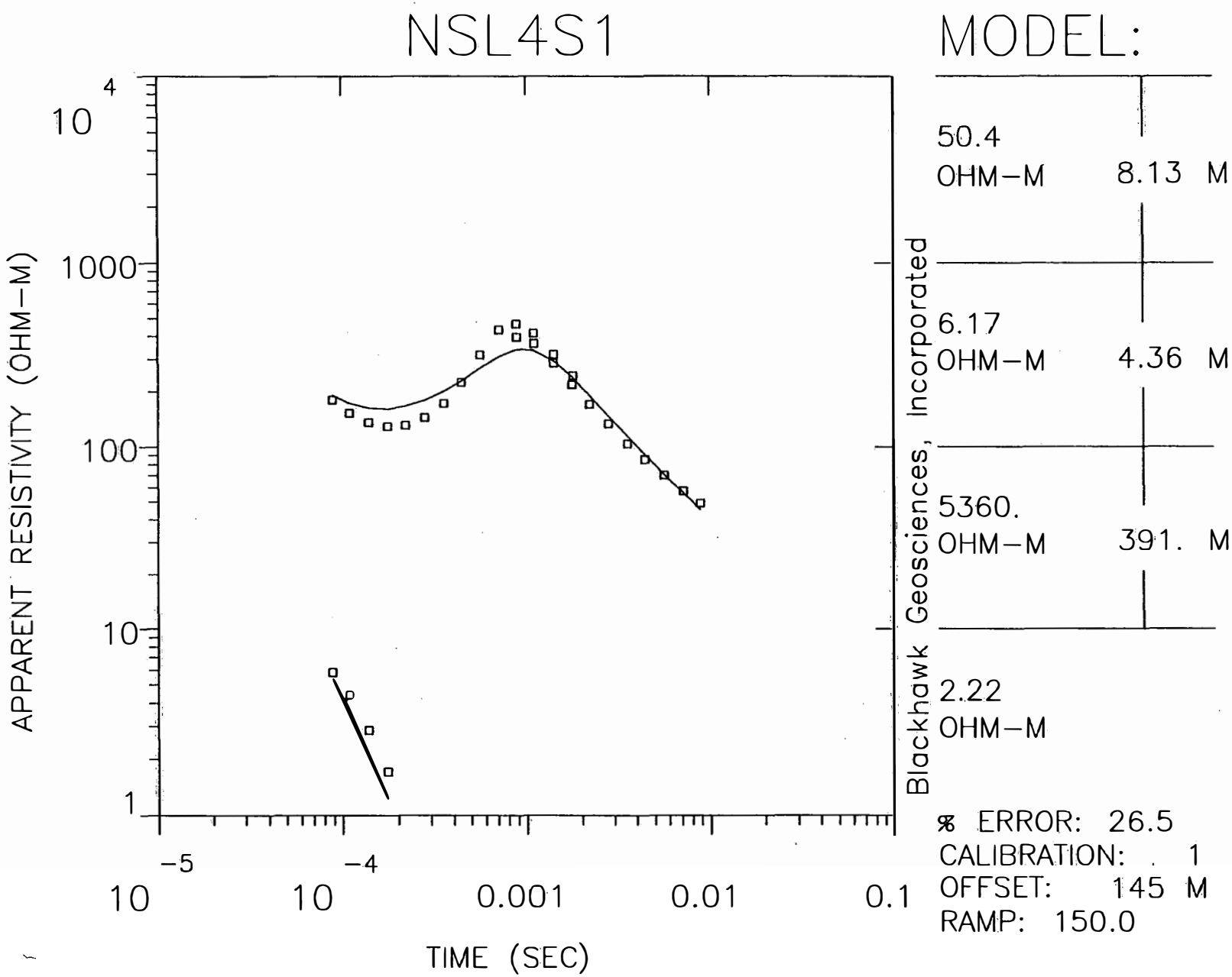
PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.60				
P 2	0.02	0.00			
P 3	0.01	-0.01	0.14		
T 1	-0.43	-0.03	0.06	0.44	
T 2	0.05	0.01	-0.02	0.06	0.95

P 1 P 2 P 3 T 1 T 2

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	26.372	34.171	42.819
	2	524.159	1023.384	3236.225
	3	1.831	2.451	2.960
THICK	1	26.304	34.740	46.740
	2	229.192	236.341	244.147
DEPTH	1	26.304	34.740	46.740
	2	266.742	271.082	275.932


NSL4S1
MODEL:
APPARENT RESISTIVITY (OHM-M)
10 4
1000
100
10
1
10 -5
10 -4
0.001
0.01
0.1
TIME (SEC)
50.4
OHM-M
8.13 M
6.17
OHM-M
4.36 M
5360.
OHM-M
391. M
2.22
OHM-M
% ERROR: 26.5
CALIBRATION: 1
OFFSET: 145 M
RAMP: 150.0
Blackhawk Geosciences, Incorporated

NSL4S1

MODEL: 4 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		339.9	1115.0		
50.43	8.1	331.7	1088.3	0.2	0.2
6.17	4.4	327.4	1074.0	0.7	0.9
5359.69	390.7	-63.3	-207.8	0.1	0.9
2.22					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	1.80E+02	1.91E+02	-5.553	
2	1.10E-04	1.53E+02	1.73E+02	-11.457	
3	1.40E-04	1.36E+02	1.63E+02	-16.278	
4	1.77E-04	1.30E+02	1.61E+02	-19.711	
5	2.20E-04	1.31E+02	1.67E+02	-21.403	
6	2.80E-04	1.45E+02	1.80E+02	-19.484	
7	3.55E-04	1.73E+02	2.01E+02	-13.704	
8	4.43E-04	2.25E+02	2.29E+02	-1.706	
9	5.64E-04	3.18E+02	2.69E+02	17.994	
10	7.13E-04	4.35E+02	3.11E+02	39.673	
11	8.81E-04	4.69E+02	3.38E+02	38.636	
12	8.90E-04	3.96E+02	3.39E+02	16.957	
13	1.10E-03	4.15E+02	3.36E+02	23.557	
14	1.10E-03	3.66E+02	3.35E+02	9.234	
15	1.40E-03	2.87E+02	2.95E+02	-2.679	
16	1.41E-03	3.20E+02	2.93E+02	9.100	
17	1.77E-03	2.18E+02	2.40E+02	-8.885	
18	1.80E-03	2.44E+02	2.36E+02	3.203	
19	2.20E-03	1.71E+02	1.92E+02	-10.912	
20	2.80E-03	1.33E+02	1.48E+02	-9.950	
21	3.55E-03	1.04E+02	1.15E+02	-9.669	
22	4.43E-03	8.54E+01	9.08E+01	-5.910	
23	5.64E-03	6.98E+01	7.07E+01	-1.243	
24	7.13E-03	5.76E+01	5.59E+01	3.136	
25	8.81E-03	4.94E+01	4.54E+01	8.609	

R: 145. X: 0. Y: 145. DL: 290. REQ: 161. CF: 1.0000
CLHZ ARRAY, 25 DATA POINTS, RAMP: 150.0 MICROSEC, DATA: NSL4S1
1708 NS 1000WZ OPR XTL L 6 8 -100
Ch.21 = 0.15 Ch.22 = 0.89 Ch.23 = 14 Ch.24 = 84
RMS LOG ERROR: 1.02E-01, ANTILOG YIELDS 26.4503 %
LATE TIME PARAMETERS

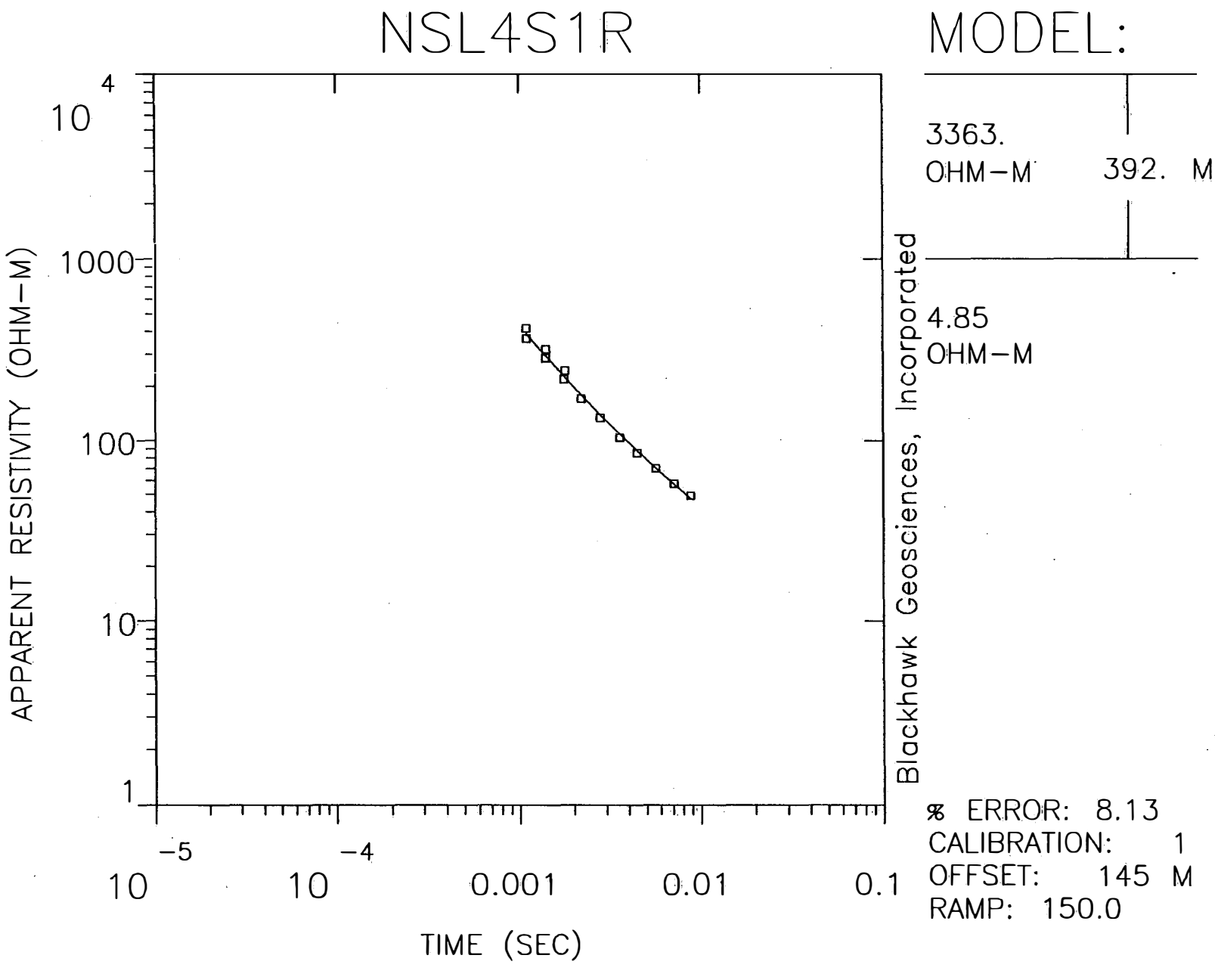
* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER
P 1 0.02
P 2 0.11 0.47

P 3	0.00	0.01	0.00				
P 4	0.00	0.00	0.00	0.05			
T 1	-0.02	-0.08	0.00	0.01	0.02		
T 2	-0.10	-0.44	-0.01	0.03	0.10	0.47	
T 3	0.00	0.00	0.00	-0.05	0.02	-0.01	0.95
	P 1	P 2	P 3	P 4	T 1	T 2	T 3

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	23.203	50.430	140.669
	2	0.745	6.168	16.217
	3	1694.882	5359.687	53596.859
	4	0.253	2.223	5.862
THICK	1	2.393	8.128	16.579
	2	0.355	4.357	13.277
	3	345.312	390.709	423.933
DEPTH	1	2.393	8.128	16.579
	2	7.311	12.485	20.640
	3	358.322	403.194	436.262


NSL4S1R
MODEL:
3363.
OHM-M
392. M
4.85
OHM-M
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
Blackhawk Geosciences, Incorporated
% ERROR: 8.13
CALIBRATION: 1
OFFSET: 145 M
RAMP: 150.0

NSL4S1R

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		339.9	1115.0		
3362.89	392.0	-52.2	-171.1	0.1	0.1
4.85					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	1.10E-03	4.15E+02	3.90E+02	6.442	
2	1.10E-03	3.66E+02	3.88E+02	-5.600	
3	1.40E-03	2.87E+02	2.95E+02	-2.703	
4	1.41E-03	3.20E+02	2.92E+02	9.403	
5	1.77E-03	2.18E+02	2.27E+02	-3.755	
6	1.80E-03	2.44E+02	2.23E+02	9.172	
7	2.20E-03	1.71E+02	1.80E+02	-4.928	
8	2.80E-03	1.33E+02	1.39E+02	-4.185	
9	3.55E-03	1.04E+02	1.09E+02	-5.302	
10	4.43E-03	8.54E+01	8.81E+01	-3.063	
11	5.64E-03	6.98E+01	7.01E+01	-0.372	
12	7.13E-03	5.76E+01	5.70E+01	1.129	
13	8.81E-03	4.94E+01	4.74E+01	4.171	

R: 145. X: 0. Y: 145. DL: 290. REQ: 161. CF: 1.0000
CLHZ ARRAY, 13 DATA POINTS, RAMP: 150.0 MICROSEC, DATA: NSL4S1R
1708 NS 1000WZ OPR XTL L 6 8 -100
Ch.21 = 0.15 Ch.22 = 0.89 Ch.23 = 14 Ch.24 = 84
RMS LOG ERROR: 3.40E-02, ANTILOG YIELDS 8.1346 %
LATE TIME PARAMETERS

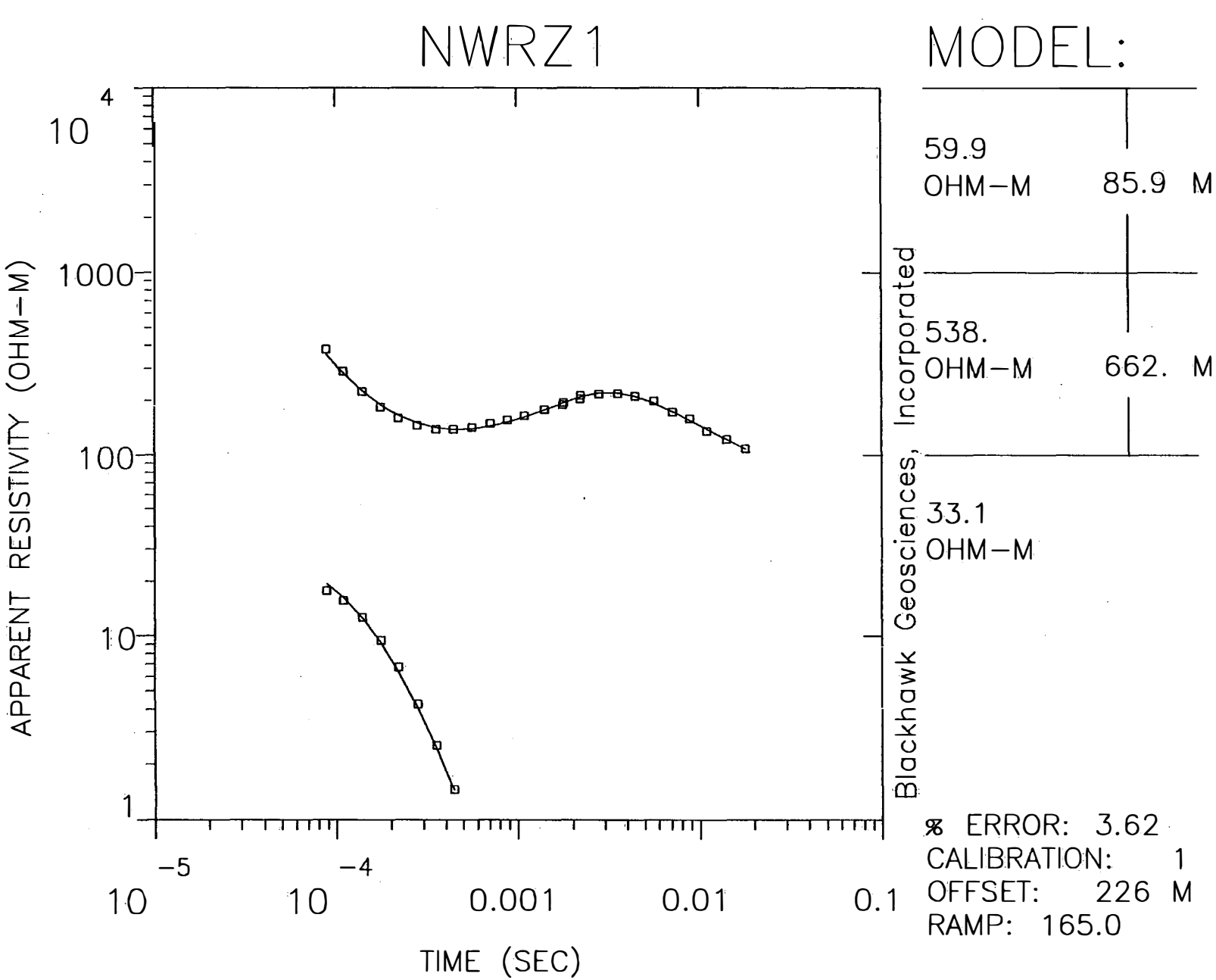
* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.06		
P 2	-0.11	0.85	
T 1	0.00	0.00	1.00
	P 1	P 2	T 1

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	1063.438	3362.888	10634.385
	2	3.719	4.849	6.321
THICK	1	384.937	392.012	399.091
DEPTH	1	384.937	392.012	399.091


NWRZ1
MODEL:
APPARENT RESISTIVITY (OHM-M)
10 4
1000
100
10
1
10 -5
10 -4
0.001
0.01
0.1
TIME (SEC)
59.9
OHM-M
85.9 M
538.
OHM-M
662. M
33.1
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 3.62
CALIBRATION: 1
OFFSET: 226 M
RAMP: 165.0

NWRZ1

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		508.1	1667.0		
59.91	85.9	422.2	1385.2	1.4	1.4
537.69	662.1	-239.9	-787.1	1.2	2.7
33.10					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	3.81E+02	3.58E+02	6.470	
2	1.10E-04	2.90E+02	2.83E+02	2.583	
3	1.40E-04	2.24E+02	2.25E+02	-0.543	
4	1.77E-04	1.84E+02	1.89E+02	-2.533	
5	2.20E-04	1.60E+02	1.66E+02	-3.732	
6	2.80E-04	1.46E+02	1.50E+02	-2.980	
7	3.55E-04	1.38E+02	1.42E+02	-2.365	
8	4.43E-04	1.38E+02	1.38E+02	-0.106	
9	5.64E-04	1.42E+02	1.39E+02	1.729	
10	7.13E-04	1.50E+02	1.44E+02	3.980	
11	8.81E-04	1.56E+02	1.51E+02	3.205	
12	1.10E-03	1.65E+02	1.62E+02	1.922	
13	1.41E-03	1.78E+02	1.78E+02	0.164	
14	1.77E-03	1.89E+02	1.94E+02	-2.316	
15	1.80E-03	1.94E+02	1.95E+02	-0.322	
16	2.20E-03	2.04E+02	2.09E+02	-2.124	
17	2.22E-03	2.12E+02	2.09E+02	1.454	
18	2.80E-03	2.17E+02	2.20E+02	-1.356	
19	3.55E-03	2.18E+02	2.21E+02	-1.093	
20	4.43E-03	2.11E+02	2.11E+02	-0.124	
21	5.64E-03	1.99E+02	1.94E+02	2.855	
22	7.13E-03	1.72E+02	1.73E+02	-0.480	
23	8.81E-03	1.58E+02	1.55E+02	1.745	
24	1.10E-02	1.35E+02	1.39E+02	-2.429	
25	1.41E-02	1.22E+02	1.22E+02	-0.016	
26	1.80E-02	1.08E+02	1.08E+02	-0.035	

R: 226. X: 0. Y: 226. DL: 452. REQ: 251. CF: 1.0000
CLHZ ARRAY, 26 DATA POINTS, RAMP: 165.0 MICROSEC, DATA: NWRZ1
1708 WR 100WZ OPR XTL L 7 8 -100
Ch.21 = 0.165 Ch.22 = 0.89 Ch.23 = 11 Ch.24 = 2
RMS LOG ERROR: 1.55E-02, ANTILOG YIELDS 3.6233 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

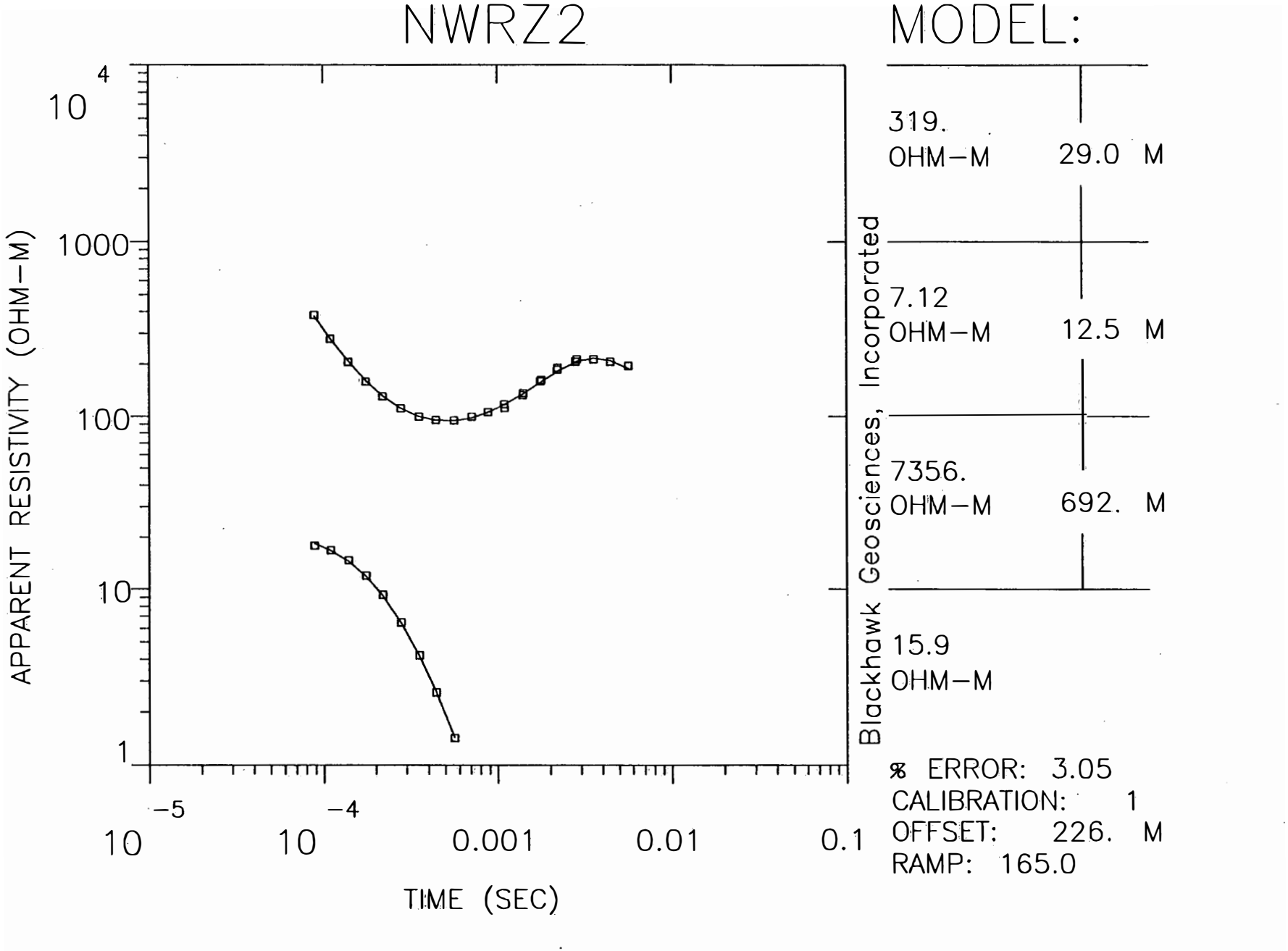
PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.98				
P 2	-0.05	0.61			
P 3	0.00	-0.09	0.83		
T 1	-0.04	-0.16	-0.02	0.91	
T 2	0.01	0.06	0.04	0.02	0.98

P 1 P 2 P 3 T 1 T 2

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	54.385	59.914	66.005
	2	416.190	537.686	747.472
	3	25.163	33.096	40.671
THICK	1	71.614	85.907	103.054
	2	604.417	662.106	710.739
DEPTH	1	71.614	85.907	103.054
	2	701.465	748.013	791.362


NWRZ2
MODEL:
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
319.
OHM-M
29.0 M
7.12
OHM-M
12.5 M
7356.
OHM-M
692. M
15.9
OHM-M
% ERROR: 3.05
CALIBRATION: 1
OFFSET: 226. M
RAMP: 165.0
Blackhawk Geosciences, Incorporated

NWRZ2

MODEL: 4 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		506.9	1663.0		
319.41	29.0	477.8	1567.7	0.1	0.1
7.12	12.5	465.4	1526.8	1.8	1.8
7355.66	691.8	-226.4	-742.8	0.1	1.9
15.93					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	3.82E+02	3.75E+02	1.995	
2	1.10E-04	2.80E+02	2.80E+02	-0.100	
3	1.40E-04	2.05E+02	2.07E+02	-0.898	
4	1.77E-04	1.58E+02	1.60E+02	-1.128	
5	2.20E-04	1.30E+02	1.31E+02	-0.828	
6	2.80E-04	1.11E+02	1.11E+02	0.055	
7	3.55E-04	9.95E+01	9.97E+01	-0.216	
8	4.43E-04	9.51E+01	9.47E+01	0.474	
9	5.64E-04	9.47E+01	9.42E+01	0.493	
10	7.13E-04	9.95E+01	9.82E+01	1.379	
11	8.81E-04	1.06E+02	1.05E+02	0.525	
12	1.10E-03	1.17E+02	1.17E+02	0.188	
13	1.10E-03	1.12E+02	1.17E+02	-4.539	
14	1.40E-03	1.32E+02	1.35E+02	-1.933	
15	1.41E-03	1.36E+02	1.36E+02	0.253	
16	1.77E-03	1.59E+02	1.58E+02	1.109	
17	1.80E-03	1.63E+02	1.59E+02	2.269	
18	2.20E-03	1.86E+02	1.81E+02	2.320	
19	2.22E-03	1.91E+02	1.83E+02	4.596	
20	2.80E-03	2.07E+02	2.05E+02	0.746	
21	2.85E-03	2.13E+02	2.07E+02	3.335	
22	3.55E-03	2.12E+02	2.16E+02	-1.907	
23	4.43E-03	2.06E+02	2.10E+02	-1.861	
24	5.64E-03	1.95E+02	1.89E+02	3.398	

R: 226. X: 0. Y: 227. DL: 453. REQ: 252. CF: 1.0000
CLHZ ARRAY, 24 DATA POINTS, RAMP: 165.0 MICROSEC, DATA: NWRZ2
1808 WR 200WZ OPR XTL L 6 8 -100 2
Ch.21 = 0.165 Ch.22 = 0.89 Ch.23 = 11 Ch.24 = 2
RMS LOG ERROR: 1.30E-02, ANTILOG YIELDS 3.0500 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

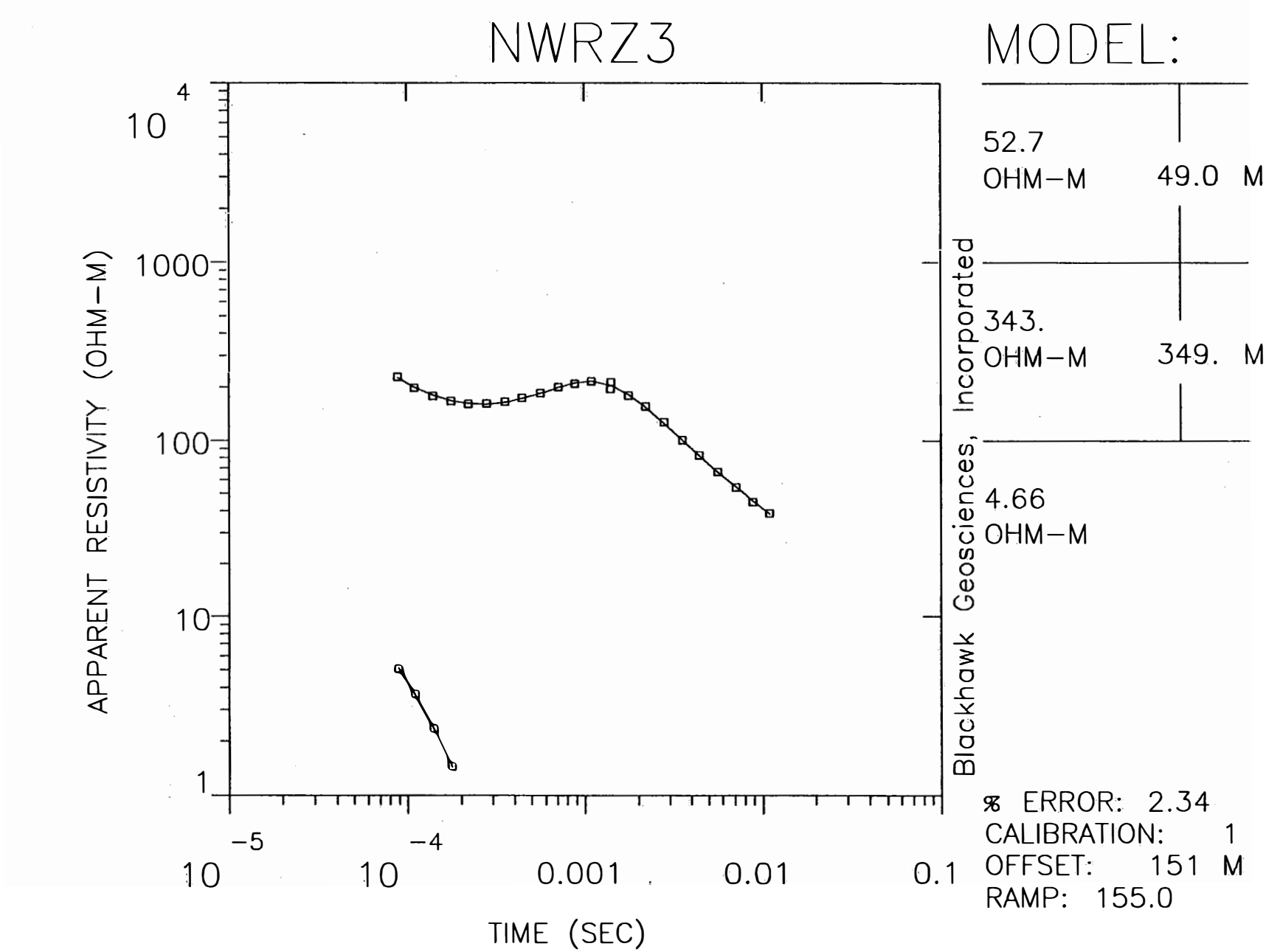
PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.15					
P 2	-0.02	0.84				
P 3	0.12	-0.07	0.12			
P 4	0.00	0.27	-0.06	0.41		
T 1	0.09	0.09	0.02	-0.14	0.94	
T 2	-0.07	-0.17	-0.07	0.28	0.10	0.81

```
T 3 -0.01 -0.02  0.00  0.02  0.01 -0.02  1.00
       P 1   P 2   P 3   P 4   T 1   T 2   T 3
```

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	171.237	319.410	435.258
	2	6.217	7.122	8.740
	3	3988.250	7355.663	13566.294
	4	10.337	15.934	20.859
THICK	1	25.863	29.037	31.607
	2	10.801	12.481	15.516
	3	681.519	691.755	707.056
DEPTH	1	25.863	29.037	31.607
	2	40.880	41.518	42.936
	3	723.740	733.273	748.306


NWRZ3
MODEL:
APPARENT RESISTIVITY (OHM-M)
10 4
1000
100
10
1
10 -5
10 -4
0.001
0.01
0.1
TIME (SEC)
52.7
OHM-M
49.0 M
343.
OHM-M
349. M
4.66
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 2.34
CALIBRATION: 1
OFFSET: 151 M
RAMP: 155.0

NWRZ3

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		339.9	1115.0		
52.69	49.0	290.8	954.2	0.9	0.9
343.21	348.7	-57.8	-189.8	1.0	1.9
4.66					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	2.28E+02	2.26E+02	0.754	
2	1.10E-04	1.98E+02	1.99E+02	-0.576	
3	1.40E-04	1.78E+02	1.79E+02	-0.814	
4	1.77E-04	1.66E+02	1.67E+02	-0.806	
5	2.20E-04	1.61E+02	1.62E+02	-0.567	
6	2.80E-04	1.61E+02	1.60E+02	0.524	
7	3.55E-04	1.65E+02	1.64E+02	0.560	
8	4.43E-04	1.74E+02	1.72E+02	1.220	
9	5.64E-04	1.85E+02	1.84E+02	0.431	
10	7.13E-04	2.00E+02	1.99E+02	0.519	
11	8.81E-04	2.09E+02	2.11E+02	-0.980	
12	1.10E-03	2.16E+02	2.16E+02	-0.028	
13	1.40E-03	1.96E+02	2.05E+02	-4.676	
14	1.41E-03	2.13E+02	2.05E+02	4.216	
15	1.77E-03	1.80E+02	1.81E+02	-0.966	
16	2.20E-03	1.56E+02	1.54E+02	0.981	
17	2.80E-03	1.27E+02	1.25E+02	1.408	
18	3.55E-03	1.01E+02	1.01E+02	0.004	
19	4.43E-03	8.26E+01	8.25E+01	0.073	
20	5.64E-03	6.69E+01	6.66E+01	0.361	
21	7.13E-03	5.44E+01	5.45E+01	-0.131	
22	8.81E-03	4.49E+01	4.58E+01	-1.915	
23	1.10E-02	3.89E+01	3.85E+01	0.874	

R: 151. X: 0. Y: 151. DL: 302. REQ: 168. CF: 1.0000
CLHZ ARRAY, 23 DATA POINTS, RAMP: 155.0 MICROSEC, DATA: NWRZ3
1808 WR 300WZ OPR XTL L 5 8 -100=302*302
Ch.21 = 0.155 Ch.22 = 0.89 Ch.23 = 14.5 Ch.24 =
RMS LOG ERROR: 1.00E-02, ANTILOG YIELDS 2.3362 %
LATE TIME PARAMETERS

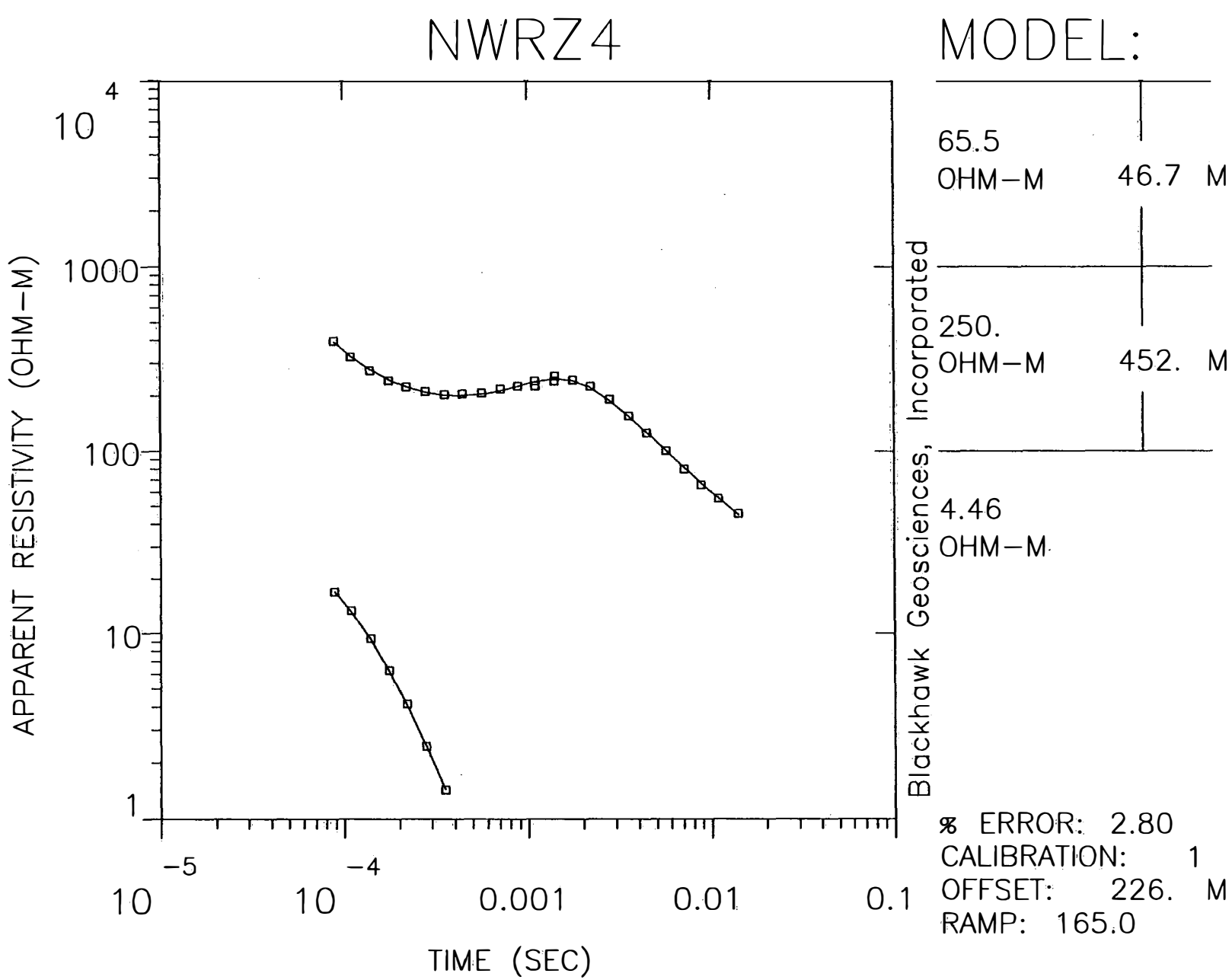
* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2
P 1	0.99				
P 2	-0.02	0.94			
P 3	0.00	-0.01	1.00		
T 1	-0.02	-0.05	0.00	0.95	
T 2	0.00	0.01	0.00	0.01	1.00

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	51.112	52.691	55.099
	2	315.767	343.207	383.544
	3	4.397	4.658	4.946
THICK	1	45.892	49.025	54.018
	2	343.071	348.667	352.531
DEPTH	1	45.892	49.025	54.018
	2	396.982	397.693	398.525


NWRZ4
MODEL:
APPARENT RESISTIVITY (OHM-M)
10 4
1000
100
10
1
10 -5
10 -4
0.001
0.01
0.1
TIME (SEC)
65.5
OHM-M
46.7 M
250.
OHM-M
452. M
4.46
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 2.80
CALIBRATION: 1
OFFSET: 226. M
RAMP: 165.0

NWRZ4

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		410.0	1345.0		
65.51	46.7	363.3	1191.9	0.7	0.7
249.61	452.5	-89.2	-292.6	1.8	2.5
4.46					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	3.95E+02	3.94E+02	0.380	
2	1.10E-04	3.25E+02	3.28E+02	-1.131	
3	1.40E-04	2.74E+02	2.78E+02	-1.215	
4	1.77E-04	2.42E+02	2.45E+02	-1.133	
5	2.20E-04	2.23E+02	2.25E+02	-0.619	
6	2.80E-04	2.11E+02	2.10E+02	0.618	
7	3.55E-04	2.04E+02	2.03E+02	0.884	
8	4.43E-04	2.05E+02	2.01E+02	1.902	
9	5.64E-04	2.08E+02	2.05E+02	1.732	
10	7.13E-04	2.18E+02	2.14E+02	1.970	
11	8.81E-04	2.27E+02	2.26E+02	0.521	
12	1.10E-03	2.41E+02	2.39E+02	0.731	
13	1.10E-03	2.26E+02	2.39E+02	-5.310	
14	1.40E-03	2.41E+02	2.48E+02	-2.822	
15	1.41E-03	2.57E+02	2.48E+02	3.611	
16	1.77E-03	2.43E+02	2.42E+02	0.458	
17	2.20E-03	2.25E+02	2.22E+02	1.549	
18	2.80E-03	1.92E+02	1.89E+02	1.739	
19	3.55E-03	1.56E+02	1.55E+02	0.596	
20	4.43E-03	1.26E+02	1.27E+02	-0.653	
21	5.64E-03	1.01E+02	1.01E+02	-0.313	
22	7.13E-03	8.03E+01	8.15E+01	-1.472	
23	8.81E-03	6.58E+01	6.74E+01	-2.271	
24	1.10E-02	5.55E+01	5.57E+01	-0.260	
25	1.41E-02	4.58E+01	4.50E+01	1.768	

R: 226. X: 0. Y: 227. DL: 453. REQ: 252. CF: 1.0000
CLHZ ARRAY, 25 DATA POINTS, RAMP: 165.0 MICROSEC, DATA: NWRZ4
1808 WR 400WZ OPR XTL L 6 8 -100
Ch.21 = 0.165 Ch.22 = 0.89 Ch.23 = 11 Ch.24 = 2
RMS LOG ERROR: 1.20E-02, ANTILOG YIELDS 2.7956 %
LATE TIME PARAMETERS

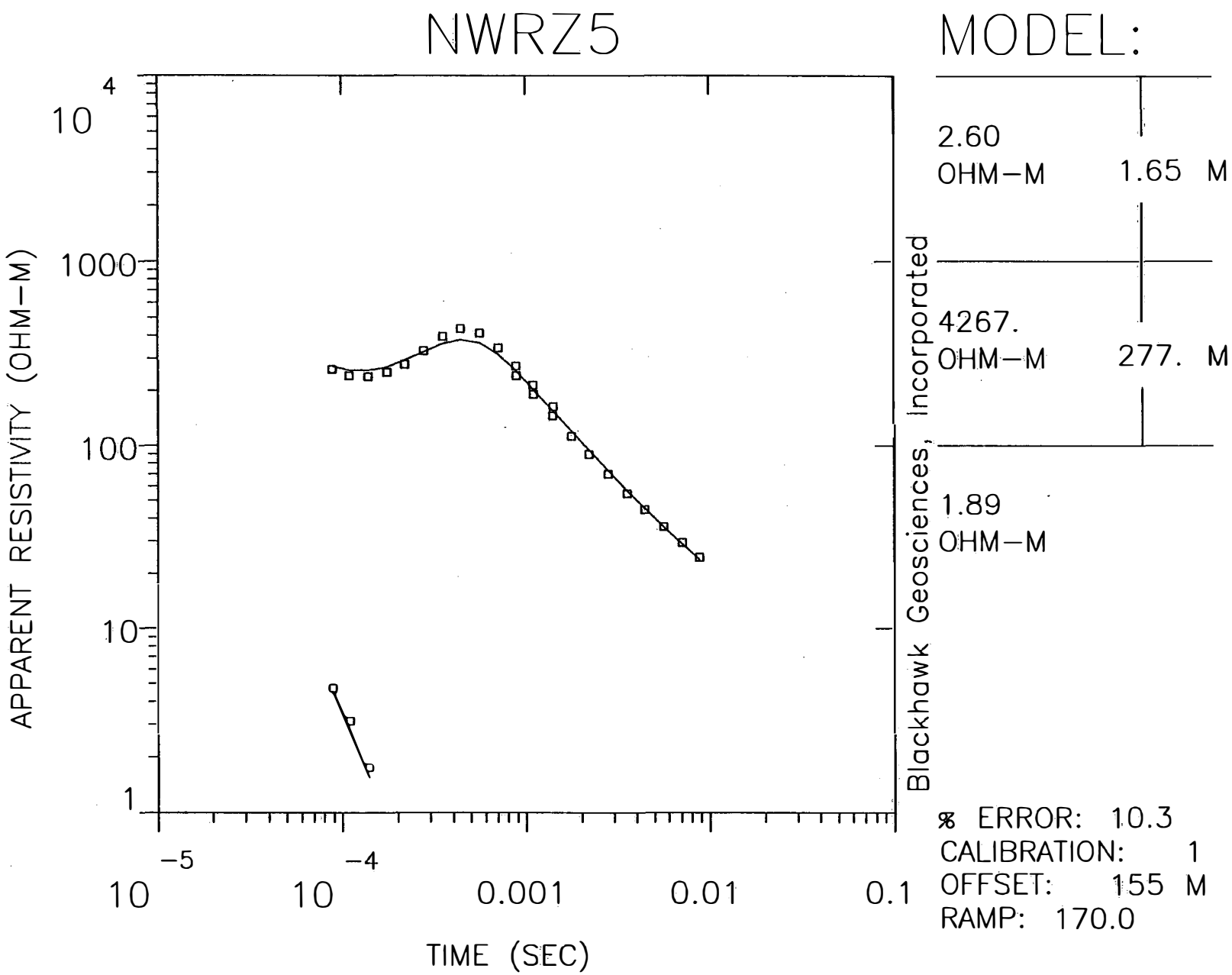
* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2
P 1	0.87				
P 2	-0.07	0.92			
P 3	-0.01	-0.06	0.82		
T 1	-0.24	-0.17	-0.05	0.50	
T 2	0.03	0.02	0.01	0.06	0.99

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	56.393	65.509	80.999
	2	229.555	249.607	292.663
	3	3.622	4.460	5.501
THICK	1	35.057	46.666	72.656
	2	426.011	452.461	468.302
DEPTH	1	35.057	46.666	72.656
	2	498.668	499.127	503.419


NWRZ5
MODEL:
APPARENT RESISTIVITY (OHM-M)
10 4
1000
100
10
1
10 -5
10 -4
0.001
0.01
0.1
TIME (SEC)
2.60
OHM-M
1.65 M
4267.
OHM-M
277. M
1.89
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 10.3
CALIBRATION: 1
OFFSET: 155 M
RAMP: 170.0

NWRZ5

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		246.0	807.0		
2.60	1.7	244.3	801.6	0.6	0.6
4267.23	277.2	-32.9	-107.8	0.1	0.7
1.89					

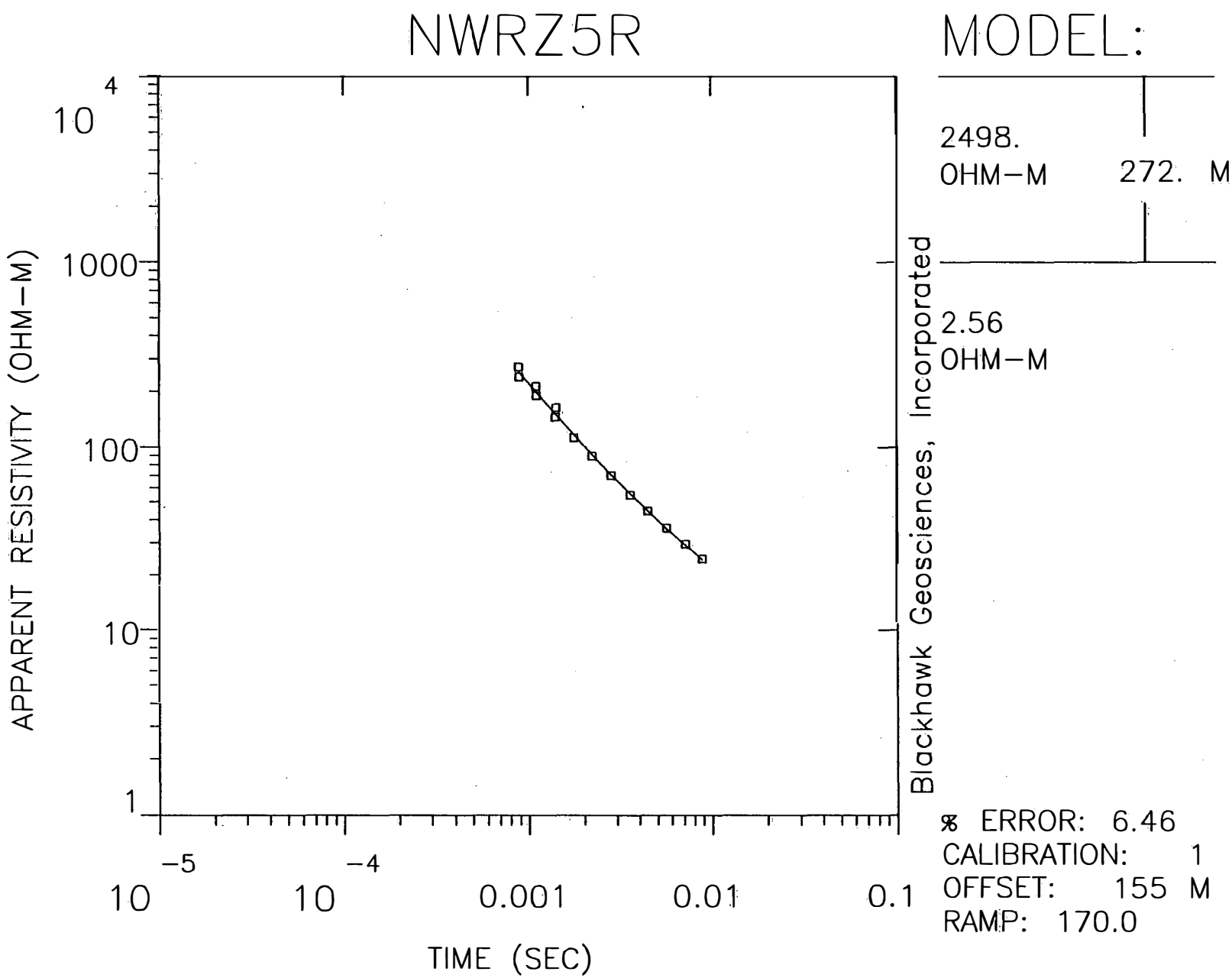
	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	2.61E+02	2.72E+02	-3.958	
2	1.10E-04	2.41E+02	2.59E+02	-6.791	
3	1.40E-04	2.37E+02	2.58E+02	-8.065	
4	1.77E-04	2.51E+02	2.70E+02	-7.148	
5	2.20E-04	2.78E+02	2.91E+02	-4.579	
6	2.80E-04	3.30E+02	3.24E+02	1.651	
7	3.55E-04	3.93E+02	3.60E+02	9.193	
8	4.43E-04	4.35E+02	3.79E+02	14.704	
9	5.64E-04	4.11E+02	3.65E+02	12.712	
10	7.13E-04	3.41E+02	3.14E+02	8.744	
11	8.81E-04	2.72E+02	2.57E+02	6.094	
12	8.90E-04	2.41E+02	2.54E+02	-4.967	
13	1.10E-03	2.14E+02	2.03E+02	5.507	
14	1.10E-03	1.91E+02	2.02E+02	-5.830	
15	1.40E-03	1.46E+02	1.55E+02	-6.187	
16	1.41E-03	1.64E+02	1.54E+02	6.242	
17	1.77E-03	1.13E+02	1.20E+02	-6.121	
18	2.20E-03	8.94E+01	9.47E+01	-5.574	
19	2.80E-03	7.01E+01	7.31E+01	-4.175	
20	3.55E-03	5.48E+01	5.71E+01	-3.934	
21	4.43E-03	4.47E+01	4.56E+01	-1.982	
22	5.64E-03	3.60E+01	3.60E+01	0.030	
23	7.13E-03	2.95E+01	2.88E+01	2.370	
24	8.81E-03	2.45E+01	2.38E+01	2.997	

R: 155. X: 0. Y: 155. DL: 310. REQ: 172. CF: 1.0000
CLHZ ARRAY, 24 DATA POINTS, RAMP: 170.0 MICROSEC, DATA: NWRZ5
1908 WR 500NZ OPR XTL L 6 8 -100=310*310
Ch.21 = 0.17 Ch.22 = 0.89 Ch.23 = 14.25 Ch.24 =
RMS LOG ERROR: 4.25E-02, ANTILOG YIELDS 10.2924 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.49				
P 2	0.01	0.00			
P 3	0.00	0.00	0.07		
T 1	-0.46	-0.01	0.03	0.49	
T 2	0.00	0.00	-0.04	-0.01	0.96
	P 1	P 2	P 3	T 1	T 2


NWRZ5R
MODEL:
2498.
OHM-M
272. M
2.56
OHM-M
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
Blackhawk Geosciences, Incorporated
% ERROR: 6.46
CALIBRATION: 1
OFFSET: 155 M
RAMP: 170.0

NWRZ5R

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		246.0	807.0		
2497.70	272.4	-26.4	-86.6	0.1	0.1
2.56					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.81E-04	2.72E+02	2.59E+02	5.226	
2	8.90E-04	2.41E+02	2.56E+02	-5.597	
3	1.10E-03	2.14E+02	2.00E+02	7.137	
4	1.10E-03	1.91E+02	1.99E+02	-4.350	
5	1.40E-03	1.46E+02	1.51E+02	-3.559	
6	1.41E-03	1.64E+02	1.50E+02	9.245	
7	1.77E-03	1.13E+02	1.16E+02	-3.073	
8	2.20E-03	8.94E+01	9.17E+01	-2.543	
9	2.80E-03	7.01E+01	7.11E+01	-1.470	
10	3.55E-03	5.48E+01	5.59E+01	-1.837	
11	4.43E-03	4.47E+01	4.50E+01	-0.625	
12	5.64E-03	3.60E+01	3.58E+01	0.355	
13	7.13E-03	2.95E+01	2.91E+01	1.546	
14	8.81E-03	2.45E+01	2.43E+01	0.996	

R: 155. X: 0. Y: 155. DL: 310. REQ: 172. CF: 1.0000
CLHZ ARRAY, 14 DATA POINTS, RAMP: 170.0 MICROSEC, DATA: NWRZ5R
1908 WR 500NZ OPR XTL L 6 8 -100=310*310
Ch.21 = 0.17 Ch.22 = 0.89 Ch.23 = 14.25 Ch.24 =
RMS LOG ERROR: 2.72E-02, ANTILOG YIELDS 6.4572 %
LATE TIME PARAMETERS

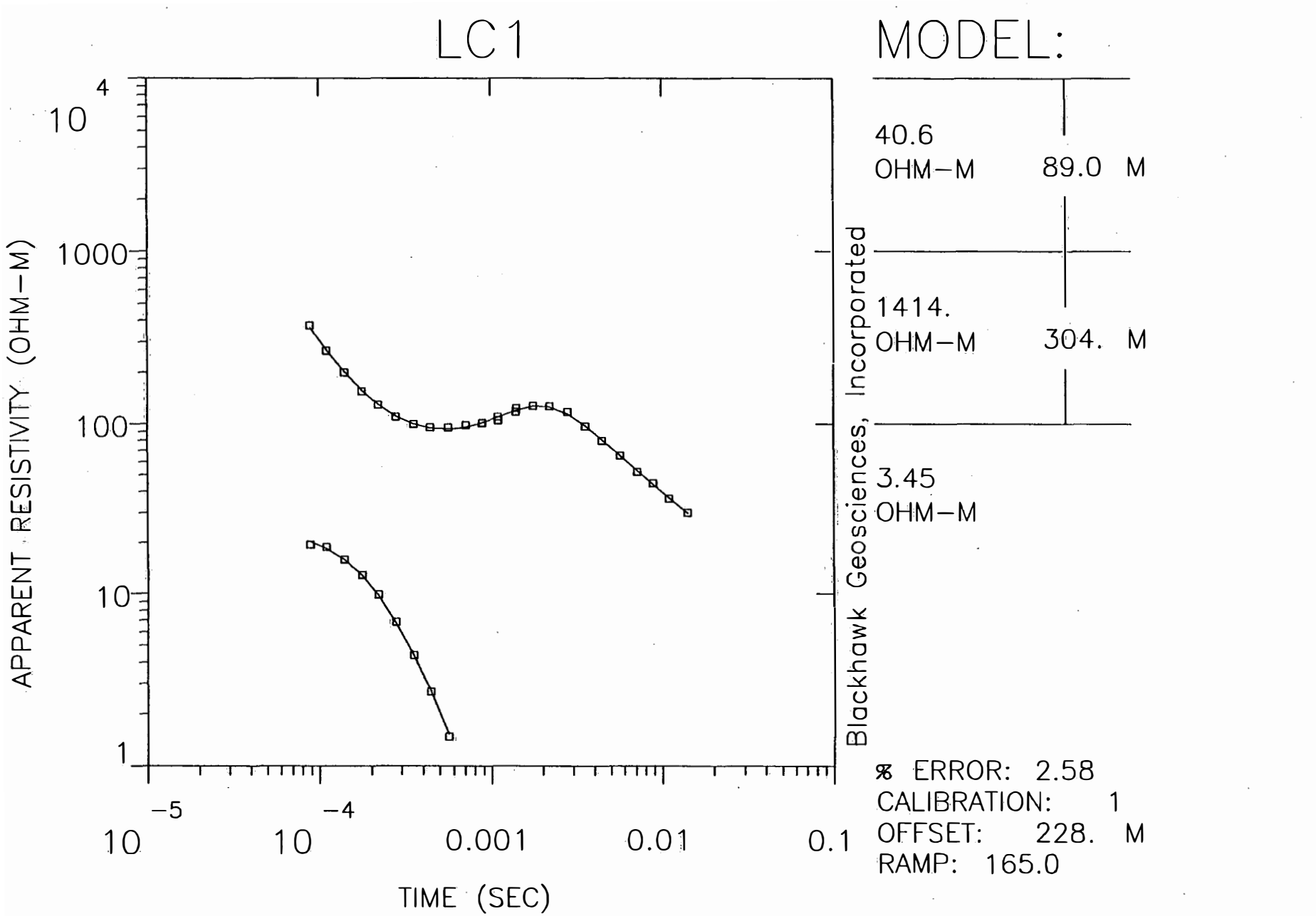
* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.03		
P 2	-0.02	1.00	
T 1	0.00	0.00	1.00
	P 1	P 2	T 1

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	321.113	2497.699	8814.285
	2	1.775	2.555	3.066
THICK	1	270.010	272.378	276.276
DEPTH	1	270.010	272.378	276.276


LC1
MODEL:
APPARENT RESISTIVITY (OHM-M)
10 4
1000
100
10
1
10 -5
10 -4
0.001
0.01
0.1
TIME (SEC)
40.6
OHM-M
89.0 M
1414.
OHM-M
304. M
3.45
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 2.58
CALIBRATION: 1
OFFSET: 228. M
RAMP: 165.0

LC1

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		360.0	1181.0		
40.63	89.0	271.0	889.1	2.2	2.2
1413.91	304.1	-33.1	-108.6	0.2	2.4
3.45					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	3.72E+02	3.62E+02	2.780	
2	1.10E-04	2.66E+02	2.70E+02	-1.394	
3	1.40E-04	1.99E+02	2.00E+02	-0.504	
4	1.77E-04	1.55E+02	1.57E+02	-1.006	
5	2.20E-04	1.29E+02	1.30E+02	-0.721	
6	2.80E-04	1.10E+02	1.11E+02	-0.846	
7	3.55E-04	9.96E+01	9.97E+01	-0.075	
8	4.43E-04	9.52E+01	9.44E+01	0.926	
9	5.64E-04	9.50E+01	9.30E+01	2.157	
10	7.13E-04	9.83E+01	9.57E+01	2.716	
11	8.81E-04	1.01E+02	1.01E+02	-0.302	
12	8.90E-04	1.01E+02	1.02E+02	-0.449	
13	1.10E-03	1.10E+02	1.09E+02	0.301	
14	1.10E-03	1.04E+02	1.10E+02	-4.870	
15	1.40E-03	1.17E+02	1.20E+02	-2.010	
16	1.41E-03	1.23E+02	1.20E+02	2.598	
17	1.77E-03	1.27E+02	1.27E+02	0.366	
18	2.20E-03	1.27E+02	1.26E+02	0.852	
19	2.80E-03	1.17E+02	1.14E+02	2.598	
20	3.55E-03	9.61E+01	9.71E+01	-0.964	
21	4.43E-03	7.99E+01	8.07E+01	-1.005	
22	5.64E-03	6.51E+01	6.52E+01	-0.061	
23	7.13E-03	5.23E+01	5.29E+01	-1.108	
24	8.81E-03	4.46E+01	4.40E+01	1.493	
25	1.10E-02	3.62E+01	3.66E+01	-0.920	
26	1.41E-02	3.00E+01	2.98E+01	0.691	

R: 228. X: 0. Y: 229. DL: 457. REQ: 254. CF: 1.0000
CLHZ ARRAY, 26 DATA POINTS, RAMP: 165.0 MICROSEC, DATA: LC1
2610 LC 100NZ OPR XTL L 6 10-100
Ch.21 = 0.165 Ch.22 = 0.89 Ch.23 = 11 Ch.24 = 2
RMS LOG ERROR: 1.10E-02, ANTILOG YIELDS 2.5765 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

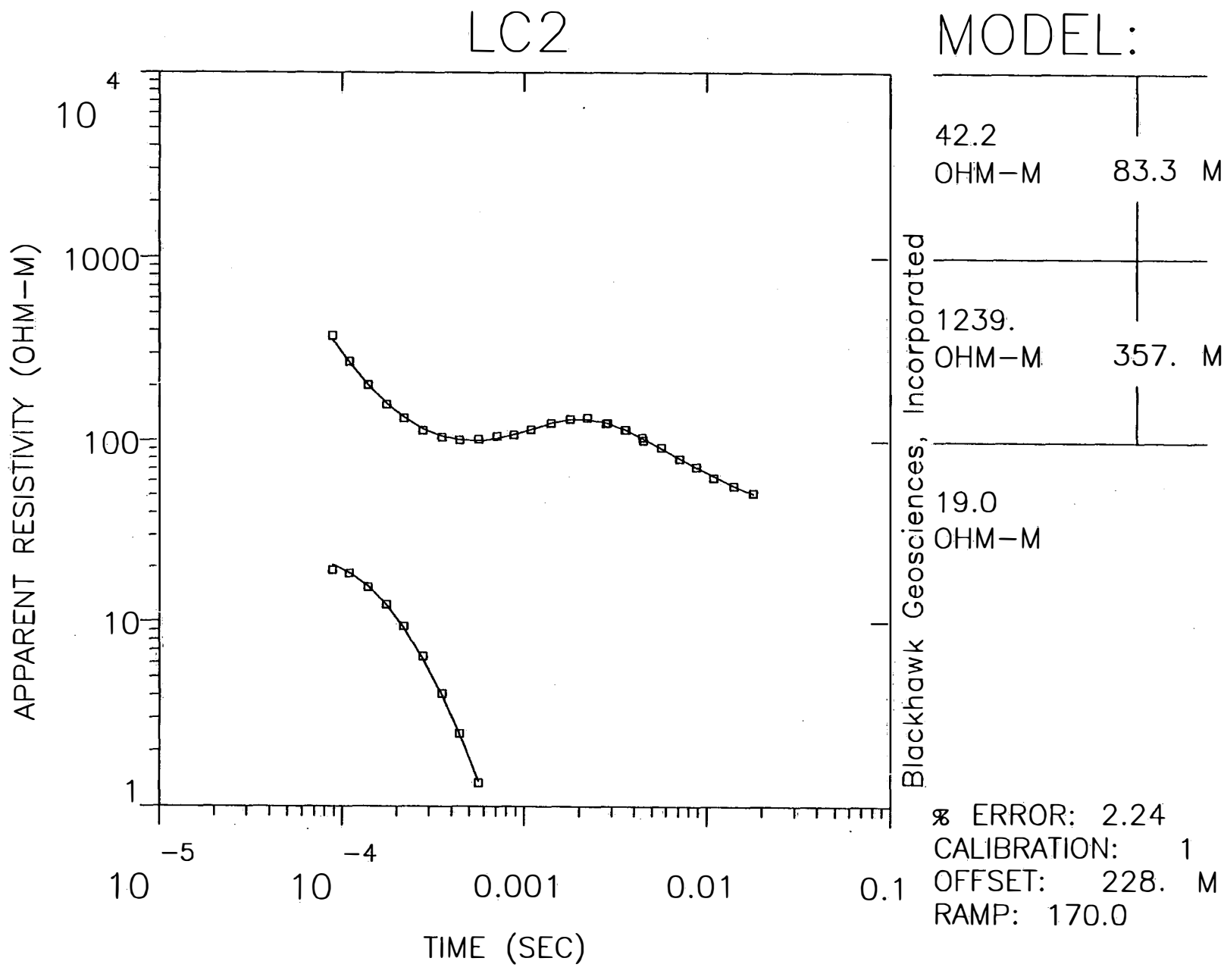
PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	1.00				
P 2	0.00	0.07			
P 3	0.00	-0.01	0.99		
T 1	0.00	-0.02	0.00	1.00	
T 2	0.00	0.01	0.00	0.00	1.00

P 1 P 2 P 3 T 1 T 2

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	37.616	40.631	43.501
	2	645.487	1413.908	5821.958
	3	2.874	3.449	4.138
THICK	1	78.647	88.982	99.258
	2	295.951	304.088	313.551
DEPTH	1	78.647	88.982	99.258
	2	391.087	393.070	395.209


LC2
MODEL:
42.2
OHM-M
83.3 M
1239.
OHM-M
357. M
19.0
OHM-M
% ERROR: 2.24
CALIBRATION: 1
OFFSET: 228. M
RAMP: 170.0
Blackhawk Geosciences, Incorporated
APPARENT RESISTIVITY (OHM-M)
TIME (SEC)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1

LC2

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		392.0	1286.0		
42.15	83.3	308.7	1012.9	2.0	2.0
1238.80	356.6	-47.9	-157.1	0.3	2.3
18.97					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	3.75E+02	3.57E+02	5.175	
2	1.10E-04	2.70E+02	2.69E+02	0.576	
3	1.40E-04	2.03E+02	2.02E+02	0.673	
4	1.77E-04	1.59E+02	1.60E+02	-0.692	
5	2.20E-04	1.33E+02	1.34E+02	-1.168	
6	2.80E-04	1.14E+02	1.16E+02	-1.950	
7	3.55E-04	1.05E+02	1.06E+02	-1.406	
8	4.43E-04	1.01E+02	1.01E+02	-0.265	
9	5.64E-04	1.02E+02	1.00E+02	1.381	
10	7.13E-04	1.06E+02	1.03E+02	2.360	
11	8.81E-04	1.08E+02	1.08E+02	-0.604	
12	1.10E-03	1.15E+02	1.16E+02	-0.535	
13	1.41E-03	1.24E+02	1.25E+02	-0.324	
14	1.80E-03	1.32E+02	1.31E+02	0.672	
15	2.22E-03	1.34E+02	1.32E+02	1.782	
16	2.80E-03	1.25E+02	1.26E+02	-0.838	
17	2.85E-03	1.26E+02	1.26E+02	0.047	
18	3.55E-03	1.15E+02	1.15E+02	-0.389	
19	3.60E-03	1.15E+02	1.15E+02	0.326	
20	4.43E-03	1.05E+02	1.04E+02	1.036	
21	4.49E-03	1.01E+02	1.03E+02	-2.001	
22	5.64E-03	9.17E+01	9.09E+01	0.929	
23	7.13E-03	7.99E+01	7.99E+01	-0.025	
24	8.81E-03	7.16E+01	7.14E+01	0.221	
25	1.10E-02	6.27E+01	6.39E+01	-1.949	
26	1.41E-02	5.66E+01	5.66E+01	0.017	
27	1.80E-02	5.16E+01	5.09E+01	1.439	

R: 228. X: 0. Y: 229. DL: 457. REQ: 254. CF: 1.0000
CLHZ ARRAY, 27 DATA POINTS, RAMP: 170.0 MICROSEC, DATA: LC2
2710 LC 200WZ OPR XTL L 4 12+1000
Ch.21 = 0.17 Ch.22 = 0.89 Ch.23 = 11 Ch.24 = 20
RMS LOG ERROR: 9.60E-03, ANTILOG YIELDS 2.2353 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

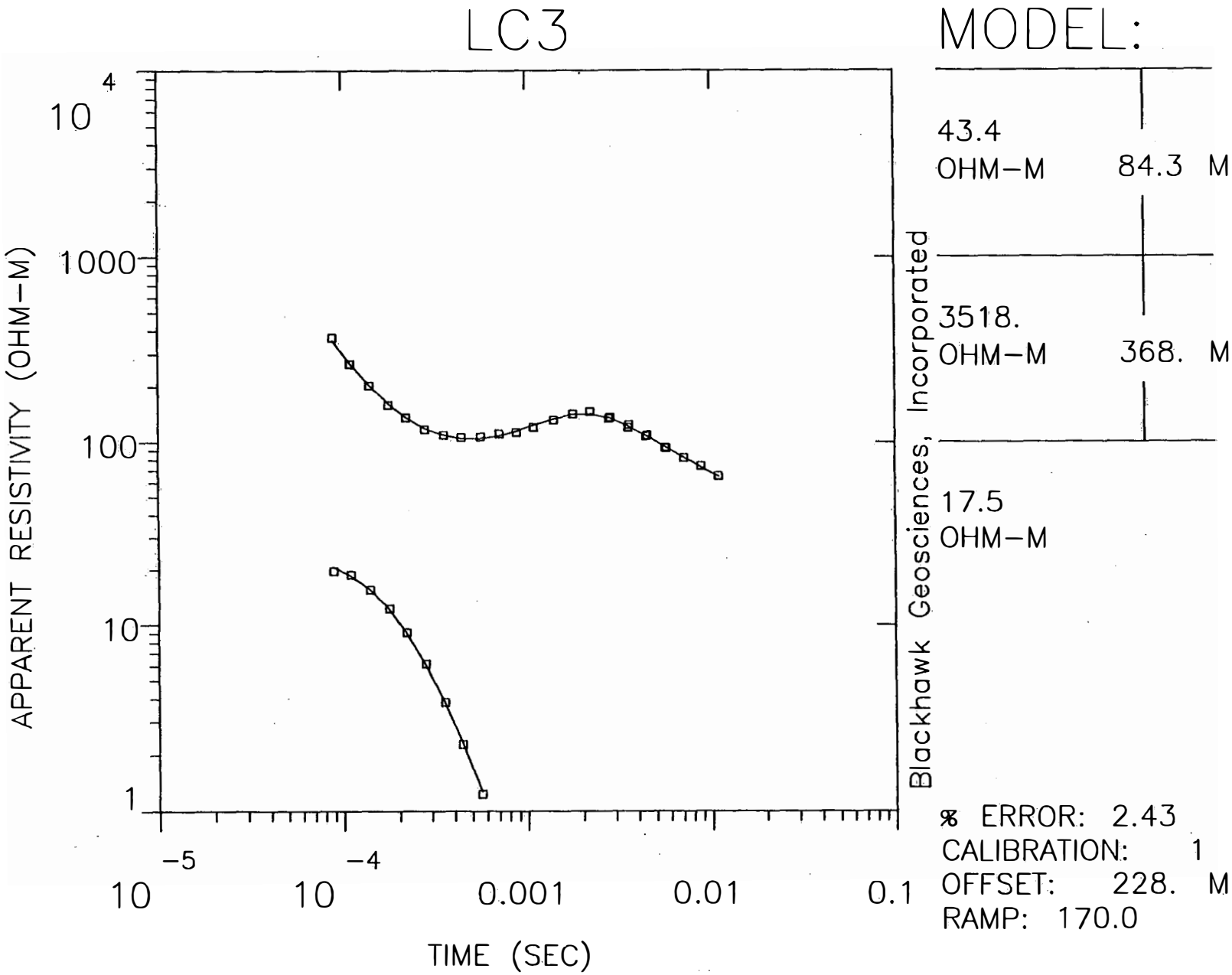
PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.98			
P 2	-0.01	0.02		
P 3	0.01	-0.02	0.94	
T 1	-0.02	-0.05	0.02	0.96

T 2 0.00 0.03 0.01 0.00 0.99
P 1 P 2 P 3 T 1 T 2

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	39.236	42.154	44.894
	2	696.628	1238.800	3310.960
	3	17.321	18.969	20.894
THICK	1	75.204	83.254	92.061
	2	345.399	356.591	367.723
DEPTH	1	75.204	83.254	92.061
	2	428.983	439.845	450.659


LC3
MODEL:
43.4
OHM-M
84.3 M
3518.
OHM-M
368. M
17.5
OHM-M
% ERROR: 2.43
CALIBRATION: 1
OFFSET: 228. M
RAMP: 170.0
Blackhawk Geosciences, Incorporated
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)

LC3

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		399.9	1312.0		
43.39	84.3	315.6	1035.3	1.9	1.9
3517.69	367.7	-52.2	-171.1	0.1	2.0
17.54					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	3.68E+02	3.55E+02	3.655	
2	1.10E-04	2.66E+02	2.69E+02	-0.806	
3	1.40E-04	2.02E+02	2.03E+02	-0.440	
4	1.77E-04	1.60E+02	1.62E+02	-1.140	
5	2.20E-04	1.36E+02	1.37E+02	-0.744	
6	2.80E-04	1.18E+02	1.19E+02	-1.266	
7	3.55E-04	1.09E+02	1.09E+02	0.034	
8	4.43E-04	1.06E+02	1.05E+02	1.347	
9	5.64E-04	1.07E+02	1.05E+02	2.441	
10	7.13E-04	1.11E+02	1.08E+02	2.213	
11	8.81E-04	1.13E+02	1.15E+02	-1.642	
12	1.10E-03	1.21E+02	1.23E+02	-2.259	
13	1.41E-03	1.32E+02	1.34E+02	-1.623	
14	1.80E-03	1.42E+02	1.42E+02	0.505	
15	2.22E-03	1.46E+02	1.42E+02	2.935	
16	2.80E-03	1.34E+02	1.35E+02	-0.963	
17	2.85E-03	1.36E+02	1.35E+02	1.113	
18	3.55E-03	1.20E+02	1.23E+02	-1.955	
19	3.60E-03	1.24E+02	1.22E+02	2.185	
20	4.43E-03	1.08E+02	1.09E+02	-1.151	
21	4.49E-03	1.09E+02	1.08E+02	0.689	
22	5.64E-03	9.34E+01	9.45E+01	-1.184	
23	5.70E-03	9.27E+01	9.40E+01	-1.314	
24	7.13E-03	8.20E+01	8.24E+01	-0.473	
25	8.81E-03	7.38E+01	7.30E+01	1.069	
26	1.10E-02	6.55E+01	6.49E+01	0.911	

R: 228. X: 0. Y: 229. DL: 457. REQ: 254. CF: 1.0000
CLHZ ARRAY, 26 DATA POINTS, RAMP: 170.0 MICROSEC, DATA: LC3
2710 LC 300NZ OPR XTL L 5 12+1000
Ch.21 = 0.17 Ch.22 = 0.89 Ch.23 = 11 Ch.24 = 20
RMS LOG ERROR: 1.04E-02, ANTILOG YIELDS 2.4330 %
LATE TIME PARAMETERS

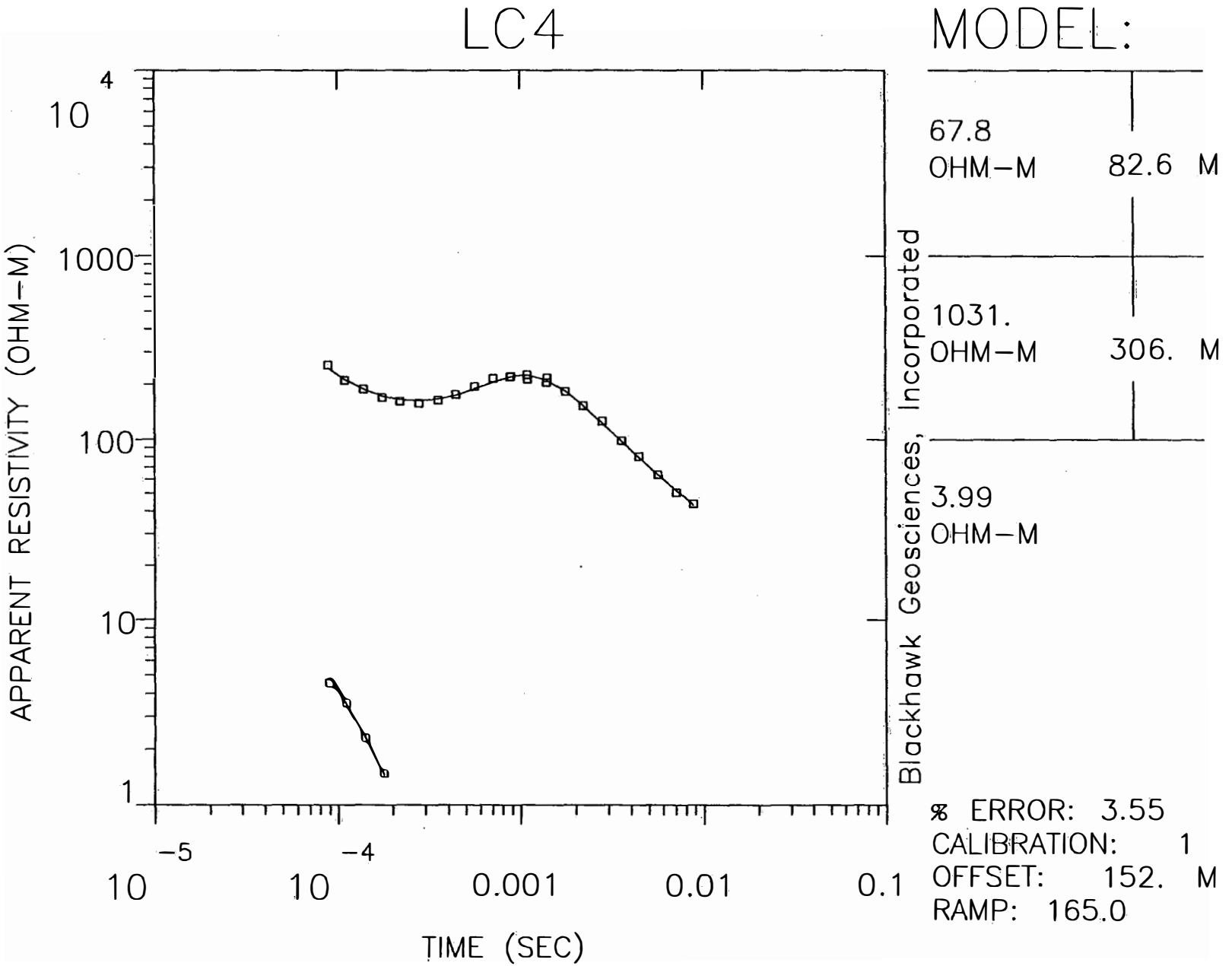
* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER
P 1 0.98
P 2 0.00 0.00

```
P 3   0.02 -0.01  0.85
T 1 -0.02 -0.02  0.03  0.96
T 2   0.00  0.01  0.02  0.00  1.00
        P 1   P 2   P 3   T 1   T 2
```

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	40.351	43.388	46.452
	2	1224.566	3517.685	11123.897
	3	14.987	17.537	20.552
THICK	1	76.214	84.326	92.745
	2	357.046	367.731	377.098
DEPTH	1	76.214	84.326	92.745
	2	440.594	452.057	462.926


LC4
MODEL:
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
67.8
OHM-M
82.6 M
1031.
OHM-M
306. M
3.99
OHM-M
% ERROR: 3.55
CALIBRATION: 1
OFFSET: 152. M
RAMP: 165.0
Blackhawk Geosciences, Incorporated

LC4

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		344.1	1129.0		
67.84	82.6	261.5	858.0	1.2	1.2
1030.52	305.8	-44.3	-145.3	0.3	1.5
3.99					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	2.54E+02	2.44E+02	4.267	
2	1.10E-04	2.10E+02	2.12E+02	-1.004	
3	1.40E-04	1.88E+02	1.87E+02	0.197	
4	1.77E-04	1.70E+02	1.73E+02	-1.576	
5	2.20E-04	1.62E+02	1.65E+02	-2.010	
6	2.80E-04	1.57E+02	1.63E+02	-3.274	
7	3.55E-04	1.64E+02	1.66E+02	-1.594	
8	4.43E-04	1.76E+02	1.75E+02	0.578	
9	5.64E-04	1.95E+02	1.89E+02	3.090	
10	7.13E-04	2.15E+02	2.06E+02	4.543	
11	8.81E-04	2.20E+02	2.19E+02	0.271	
12	8.90E-04	2.21E+02	2.20E+02	0.449	
13	1.10E-03	2.25E+02	2.24E+02	0.563	
14	1.10E-03	2.12E+02	2.24E+02	-5.213	
15	1.40E-03	2.05E+02	2.11E+02	-2.986	
16	1.41E-03	2.17E+02	2.10E+02	3.182	
17	1.77E-03	1.83E+02	1.83E+02	-0.160	
18	2.20E-03	1.53E+02	1.53E+02	-0.063	
19	2.80E-03	1.26E+02	1.23E+02	2.247	
20	3.55E-03	9.79E+01	9.81E+01	-0.216	
21	4.43E-03	8.00E+01	7.97E+01	0.458	
22	5.64E-03	6.36E+01	6.38E+01	-0.391	
23	7.13E-03	5.07E+01	5.18E+01	-2.203	
24	8.81E-03	4.40E+01	4.33E+01	1.802	

R: 152. X: 0. Y: 153. DL: 305. REQ: 170. CF: 1.0000
CLHZ ARRAY, 24 DATA POINTS, RAMP: 165.0 MICROSEC, DATA: LC4
2810 LC 400NZ OPR XTL L 6 12+100 2
Ch.21 = 0.165 Ch.22 = 0.89 Ch.23 = 15 Ch.24 = 9
RMS LOG ERROR: 1.52E-02, ANTILOG YIELDS 3.5519 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

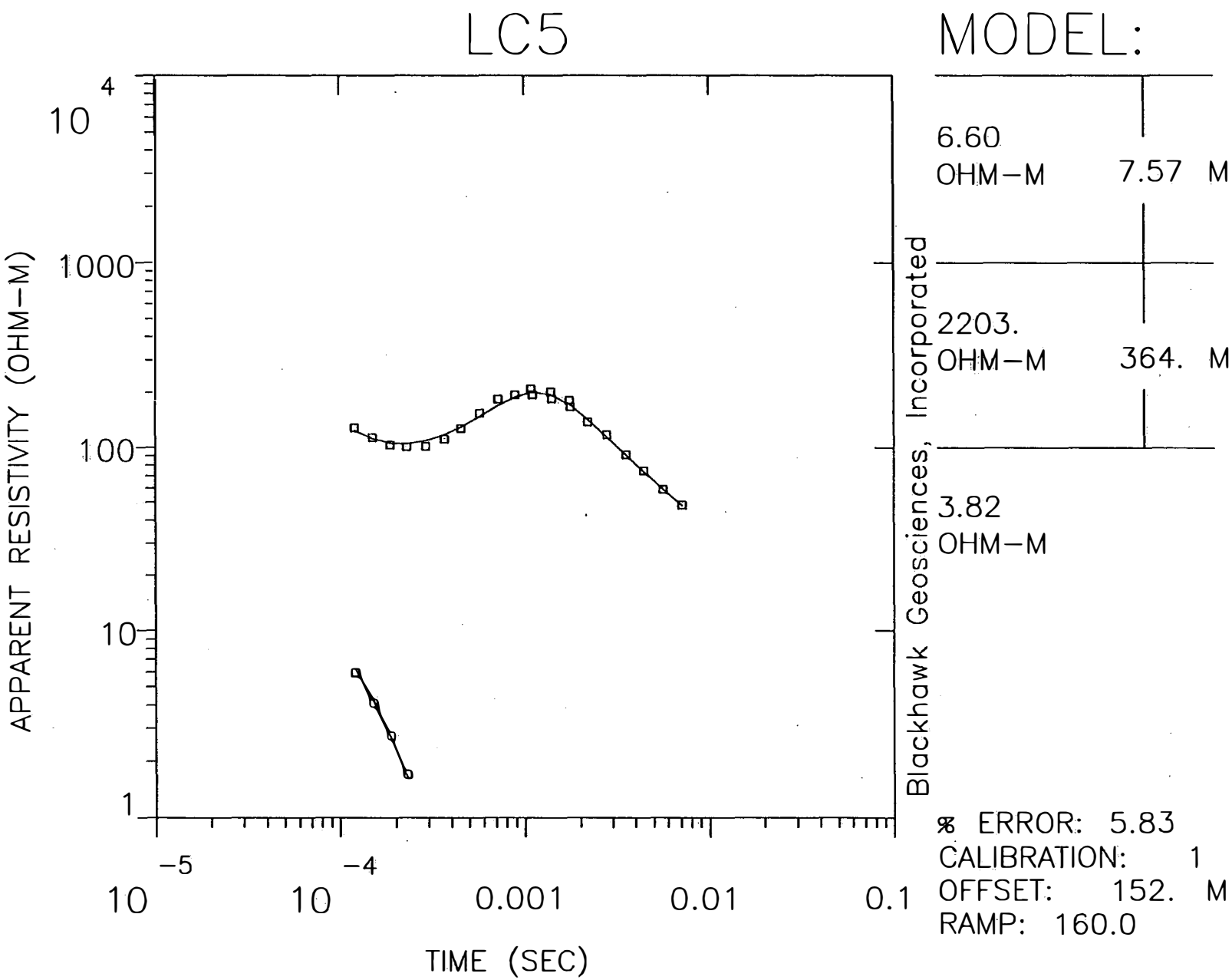
PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.98			
P 2	-0.02	0.02		
P 3	0.03	-0.03	0.73	
T 1	-0.03	-0.11	0.06	0.94

```
T 2  0.01  0.03 -0.02  0.02  0.99
       P 1   P 2   P 3   T 1   T 2
```

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	60.449	67.842	73.317
	2	592.873	1030.520	2424.972
	3	3.357	3.986	4.793
THICK	1	68.162	82.586	95.618
	2	290.521	305.831	321.386
DEPTH	1	68.162	82.586	95.618
	2	386.139	388.418	393.074


LC5
MODEL:
APPARENT RESISTIVITY (OHM-M)
10 4
1000
100
10
1
10 -5
10 -4
0.001
0.01
0.1
TIME (SEC)
6.60
OHM-M
7.57 M
2203.
OHM-M
364. M
3.82
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 5.83
CALIBRATION: 1
OFFSET: 152. M
RAMP: 160.0

LC5

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		337.7	1108.0		
6.60	7.6	330.1	1083.1	1.1	1.1
2203.02	363.8	-33.6	-110.3	0.2	1.3
3.82					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	1.21E-04	1.28E+02	1.23E+02	3.461	
2	1.51E-04	1.13E+02	1.11E+02	1.808	
3	1.87E-04	1.03E+02	1.06E+02	-2.245	
4	2.29E-04	1.01E+02	1.05E+02	-3.620	
5	2.90E-04	1.01E+02	1.08E+02	-6.592	
6	3.66E-04	1.11E+02	1.17E+02	-4.977	
7	4.54E-04	1.27E+02	1.29E+02	-1.627	
8	5.74E-04	1.53E+02	1.48E+02	3.824	
9	7.19E-04	1.84E+02	1.69E+02	8.666	
10	8.90E-04	1.94E+02	1.89E+02	2.794	
11	1.08E-03	2.09E+02	2.00E+02	4.578	
12	1.10E-03	1.94E+02	2.00E+02	-3.216	
13	1.38E-03	2.02E+02	1.95E+02	3.453	
14	1.40E-03	1.85E+02	1.94E+02	-4.395	
15	1.75E-03	1.80E+02	1.71E+02	5.307	
16	1.77E-03	1.66E+02	1.70E+02	-2.299	
17	2.20E-03	1.38E+02	1.42E+02	-3.184	
18	2.80E-03	1.17E+02	1.14E+02	2.765	
19	3.55E-03	9.14E+01	9.09E+01	0.485	
20	4.43E-03	7.43E+01	7.38E+01	0.661	
21	5.64E-03	5.89E+01	5.91E+01	-0.386	
22	7.13E-03	4.85E+01	4.81E+01	0.797	

R: 152. X: 0. Y: 153. DL: 305. REQ: 170. CF: 1.0000
CLHZ ARRAY, 22 DATA POINTS, RAMP: 160.0 MICROSEC, DATA: LC5
3110 LC 500NZ OPR XTL L 6 12+100
Ch.21 = 0.16 Ch.22 = 0.89 Ch.23 = 15 Ch.24 = 93
RMS LOG ERROR: 2.46E-02, ANTILOG YIELDS 5.8256 %
LATE TIME PARAMETERS

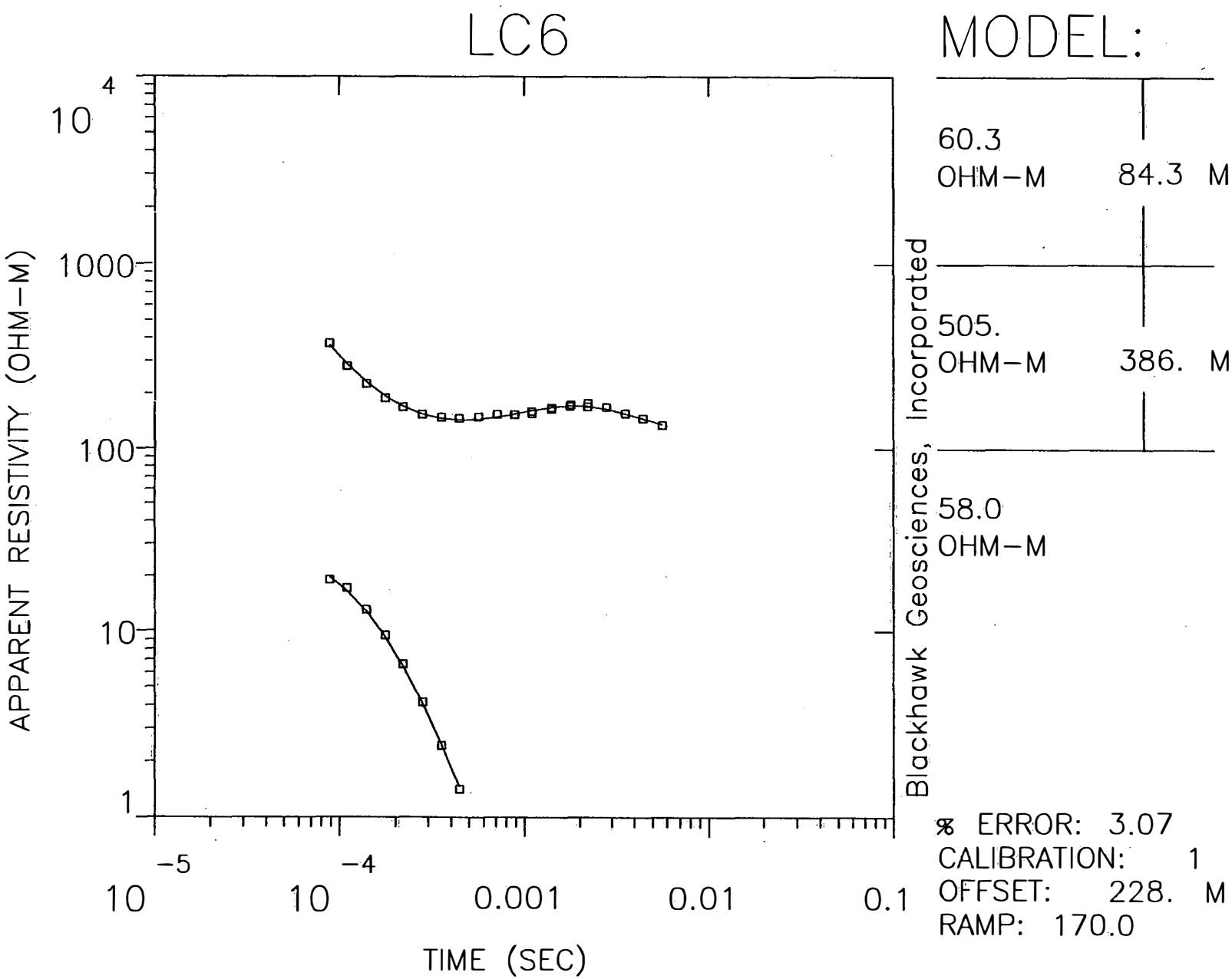
* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.82				
P 2	-0.05	0.02			
P 3	0.15	-0.02	0.53		
T 1	-0.19	-0.08	0.16	0.79	
T 2	0.00	0.00	-0.01	0.00	1.00
	P 1	P 2	P 3	T 1	T 2

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	4.584	6.596	9.502
	2	1238.847	2203.016	6966.549
	3	2.318	3.822	5.576
THICK	1	5.159	7.575	11.194
	2	355.385	363.777	373.962
DEPTH	1	5.159	7.575	11.194
	2	362.953	371.352	381.545


LC6
MODEL:
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
60.3
OHM-M
84.3 M
505.
OHM-M
386. M
58.0
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 3.07
CALIBRATION: 1
OFFSET: 228. M
RAMP: 170.0

LC6

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		452.0	1483.0		
60.27	84.3	367.7	1206.3	1.4	1.4
504.87	386.0	-18.4	-60.2	0.8	2.2
58.04					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	3.75E+02	3.67E+02	2.225	
2	1.10E-04	2.83E+02	2.90E+02	-2.470	
3	1.40E-04	2.27E+02	2.31E+02	-1.880	
4	1.77E-04	1.90E+02	1.93E+02	-1.974	
5	2.20E-04	1.69E+02	1.71E+02	-1.172	
6	2.80E-04	1.54E+02	1.55E+02	-0.632	
7	3.55E-04	1.48E+02	1.46E+02	1.301	
8	4.43E-04	1.47E+02	1.43E+02	2.632	
9	5.64E-04	1.49E+02	1.44E+02	3.598	
10	7.13E-04	1.53E+02	1.48E+02	3.403	
11	8.81E-04	1.54E+02	1.54E+02	-0.502	
12	8.90E-04	1.54E+02	1.55E+02	-0.736	
13	1.10E-03	1.60E+02	1.62E+02	-0.977	
14	1.10E-03	1.56E+02	1.62E+02	-3.676	
15	1.40E-03	1.65E+02	1.68E+02	-2.152	
16	1.41E-03	1.68E+02	1.69E+02	-0.623	
17	1.77E-03	1.71E+02	1.72E+02	-0.671	
18	1.80E-03	1.74E+02	1.72E+02	1.321	
19	2.20E-03	1.70E+02	1.71E+02	-0.311	
20	2.22E-03	1.77E+02	1.70E+02	3.978	
21	2.80E-03	1.68E+02	1.65E+02	2.338	
22	3.55E-03	1.56E+02	1.56E+02	0.204	
23	4.43E-03	1.46E+02	1.46E+02	0.082	
24	5.64E-03	1.34E+02	1.36E+02	-0.973	

R: 228. X: 0. Y: 229. DL: 457. REQ: 254. CF: 1.0000
CLHZ ARRAY, 24 DATA POINTS, RAMP: 170.0 MICROSEC, DATA: LC6
2910 LC 600NZ OPR XTL L 6 12+100
Ch.21 = 0.17 Ch.22 = 0.89 Ch.23 = 11 Ch.24 = 20
RMS LOG ERROR: 1.31E-02, ANTILOG YIELDS 3.0668 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

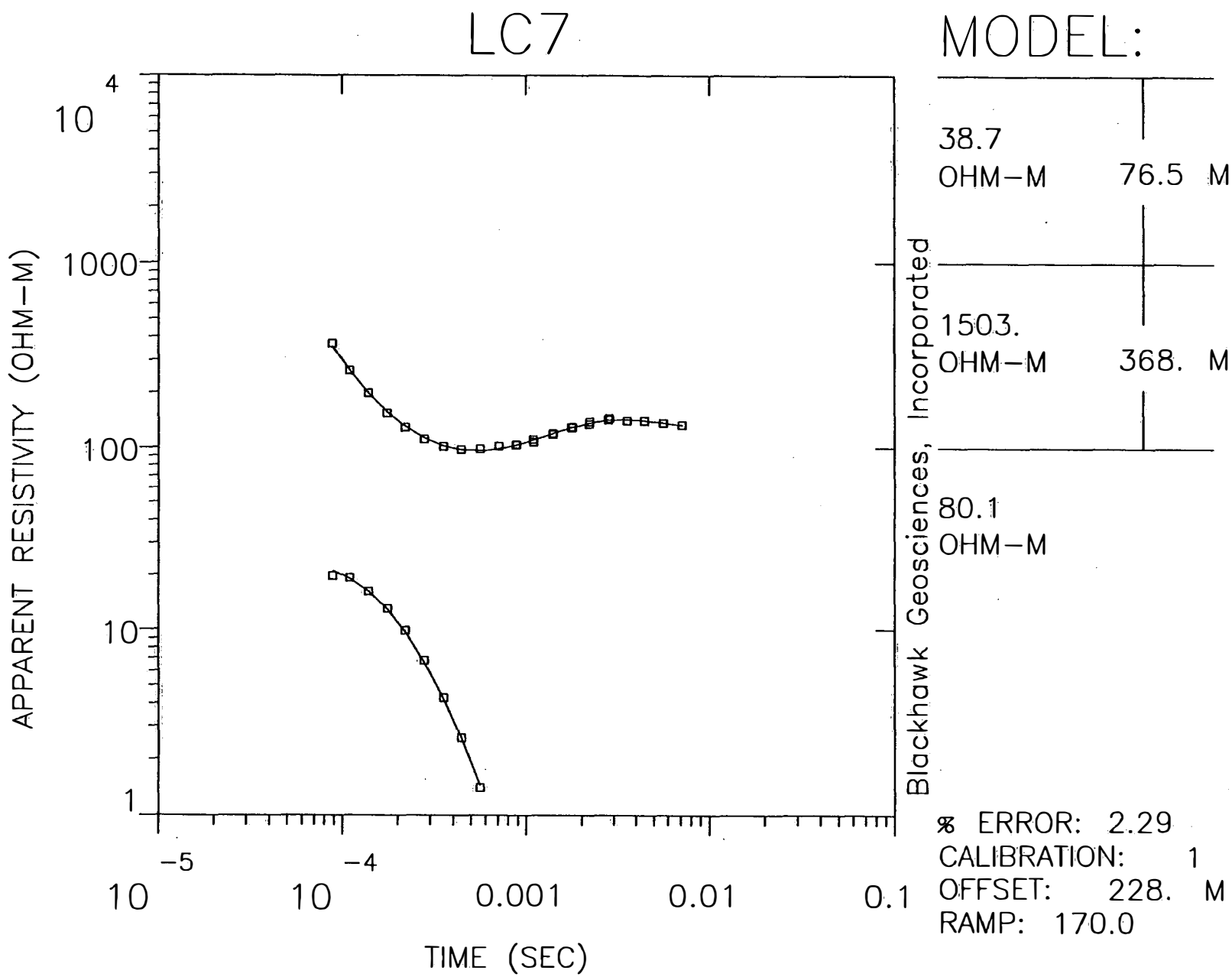
PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.98			
P 2	-0.04	0.17		
P 3	0.02	-0.11	0.71	
T 1	-0.03	-0.17	0.02	0.93

```
T 2  0.00  0.15  0.10  0.02  0.94
       P 1   P 2   P 3   T 1   T 2
```

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

LAYER		MINIMUM	BEST	MAXIMUM
RHO	1	55.549	60.273	64.931
	2	386.808	504.871	858.566
	3	39.642	58.042	78.332
THICK	1	72.739	84.343	99.586
	2	324.072	386.033	440.712
DEPTH	1	72.739	84.343	99.586
	2	412.885	470.376	527.677


LC7
MODEL:
APPARENT RESISTIVITY (OHM-M)
10 4
1000
100
10
1
10 -5
10 -4
0.001
0.01
0.1
TIME (SEC)
38.7
OHM-M
76.5 M
1503.
OHM-M
368. M
80.1
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 2.29
CALIBRATION: 1
OFFSET: 228. M
RAMP: 170.0

LC7

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		449.0	1473.0		
38.74	76.5	372.4	1221.9	2.0	2.0
1502.67	367.7	4.8	15.6	0.2	2.2
80.14					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	3.68E+02	3.53E+02	4.343	
2	1.10E-04	2.63E+02	2.64E+02	-0.424	
3	1.40E-04	1.97E+02	1.98E+02	-0.160	
4	1.77E-04	1.54E+02	1.56E+02	-1.142	
5	2.20E-04	1.29E+02	1.30E+02	-1.252	
6	2.80E-04	1.11E+02	1.12E+02	-1.571	
7	3.55E-04	1.01E+02	1.02E+02	-0.708	
8	4.43E-04	9.78E+01	9.73E+01	0.463	
9	5.64E-04	9.82E+01	9.62E+01	2.148	
10	7.13E-04	1.02E+02	9.85E+01	3.135	
11	8.81E-04	1.03E+02	1.03E+02	-0.067	
12	8.90E-04	1.04E+02	1.03E+02	0.473	
13	1.10E-03	1.10E+02	1.10E+02	0.063	
14	1.10E-03	1.07E+02	1.10E+02	-2.531	
15	1.40E-03	1.18E+02	1.19E+02	-1.115	
16	1.41E-03	1.20E+02	1.20E+02	-0.134	
17	1.77E-03	1.29E+02	1.29E+02	0.016	
18	1.80E-03	1.29E+02	1.29E+02	-0.079	
19	2.20E-03	1.35E+02	1.36E+02	-1.130	
20	2.22E-03	1.38E+02	1.36E+02	1.408	
21	2.80E-03	1.42E+02	1.41E+02	0.589	
22	2.85E-03	1.44E+02	1.41E+02	2.181	
23	3.55E-03	1.40E+02	1.42E+02	-1.757	
24	4.43E-03	1.40E+02	1.41E+02	-0.180	
25	5.64E-03	1.36E+02	1.37E+02	-0.815	
26	7.13E-03	1.33E+02	1.32E+02	0.711	

R: 228. X: 0. Y: 229. DL: 457. REQ: 254. CF: 1.0000
CLHZ ARRAY, 26 DATA POINTS, RAMP: 170.0 MICROSEC, DATA: LC7
2910 LC 700NZ OPR XTL L 6 12+100 2
Ch.21 = 0.17 Ch.22 = 0.89 Ch.23 = 11 Ch.24 = 20
RMS LOG ERROR: 9.82E-03, ANTILOG YIELDS 2.2880 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

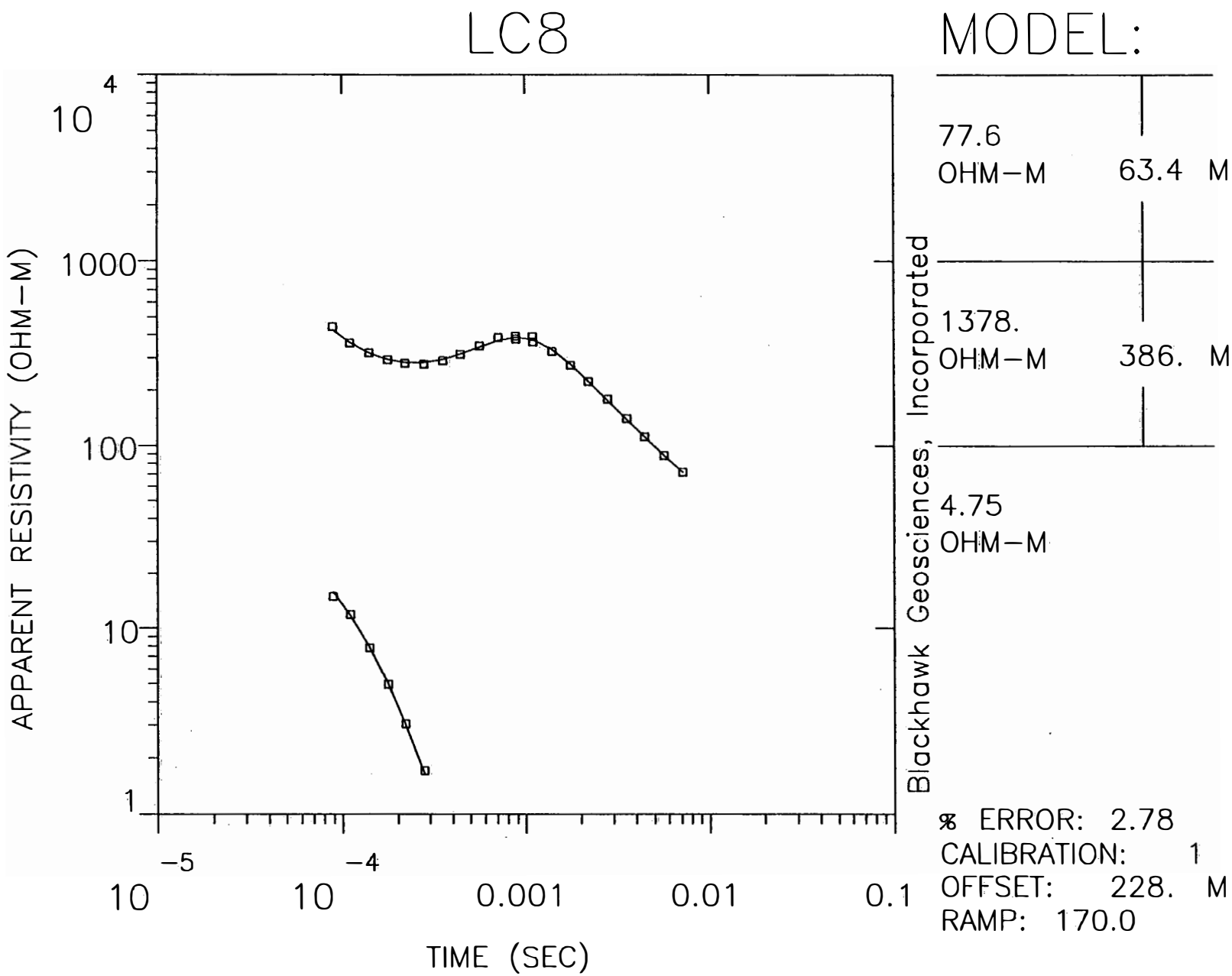
PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	1.00				
P 2	-0.01	0.23			
P 3	0.00	-0.05	0.99		
T 1	0.00	-0.03	0.00	1.00	
T 2	0.00	0.07	0.01	0.00	0.99

P 1 P 2 P 3 T 1 T 2

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	36.608	38.737	41.381
	2	793.081	1502.674	3132.842
	3	66.221	80.137	96.165
THICK	1	69.546	76.537	85.597
	2	324.198	367.666	419.394
DEPTH	1	69.546	76.537	85.597
	2	400.850	444.203	495.812


LC8
MODEL:
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
77.6
OHM-M
63.4 M
1378.
OHM-M
386. M
4.75
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 2.78
CALIBRATION: 1
OFFSET: 228. M
RAMP: 170.0

LC8

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		417.9	1371.0		
77.59	63.4	354.5	1162.9	0.8	0.8
1377.57	386.3	-31.8	-104.4	0.3	1.1
4.75					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	4.42E+02	4.26E+02	3.832	
2	1.10E-04	3.62E+02	3.64E+02	-0.759	
3	1.40E-04	3.20E+02	3.19E+02	0.281	
4	1.77E-04	2.93E+02	2.94E+02	-0.542	
5	2.20E-04	2.82E+02	2.83E+02	-0.613	
6	2.80E-04	2.77E+02	2.83E+02	-2.099	
7	3.55E-04	2.90E+02	2.94E+02	-1.298	
8	4.43E-04	3.13E+02	3.14E+02	-0.073	
9	5.64E-04	3.47E+02	3.43E+02	1.118	
10	7.13E-04	3.86E+02	3.73E+02	3.403	
11	8.81E-04	3.94E+02	3.88E+02	1.315	
12	8.90E-04	3.79E+02	3.89E+02	-2.533	
13	1.10E-03	3.90E+02	3.78E+02	3.377	
14	1.10E-03	3.65E+02	3.77E+02	-3.282	
15	1.40E-03	3.25E+02	3.33E+02	-2.381	
16	1.77E-03	2.74E+02	2.76E+02	-0.494	
17	2.20E-03	2.24E+02	2.24E+02	-0.260	
18	2.80E-03	1.79E+02	1.76E+02	1.499	
19	3.55E-03	1.40E+02	1.39E+02	0.707	
20	4.43E-03	1.12E+02	1.12E+02	-0.021	
21	5.64E-03	8.85E+01	8.88E+01	-0.388	
22	7.13E-03	7.17E+01	7.15E+01	0.224	

R: 228. X: 0. Y: 229. DL: 457. REQ: 254. CF: 1.0000
CLHZ ARRAY, 22 DATA POINTS, RAMP: 170.0 MICROSEC, DATA: LC8
2910 LC 800NZ OPR XTL L 6 8 +100
Ch.21 = 0.17 Ch.22 = 0.89 Ch.23 = 11 Ch.24 = 20
RMS LOG ERROR: 1.19E-02, ANTILOG YIELDS 2.7816 %
LATE TIME PARAMETERS

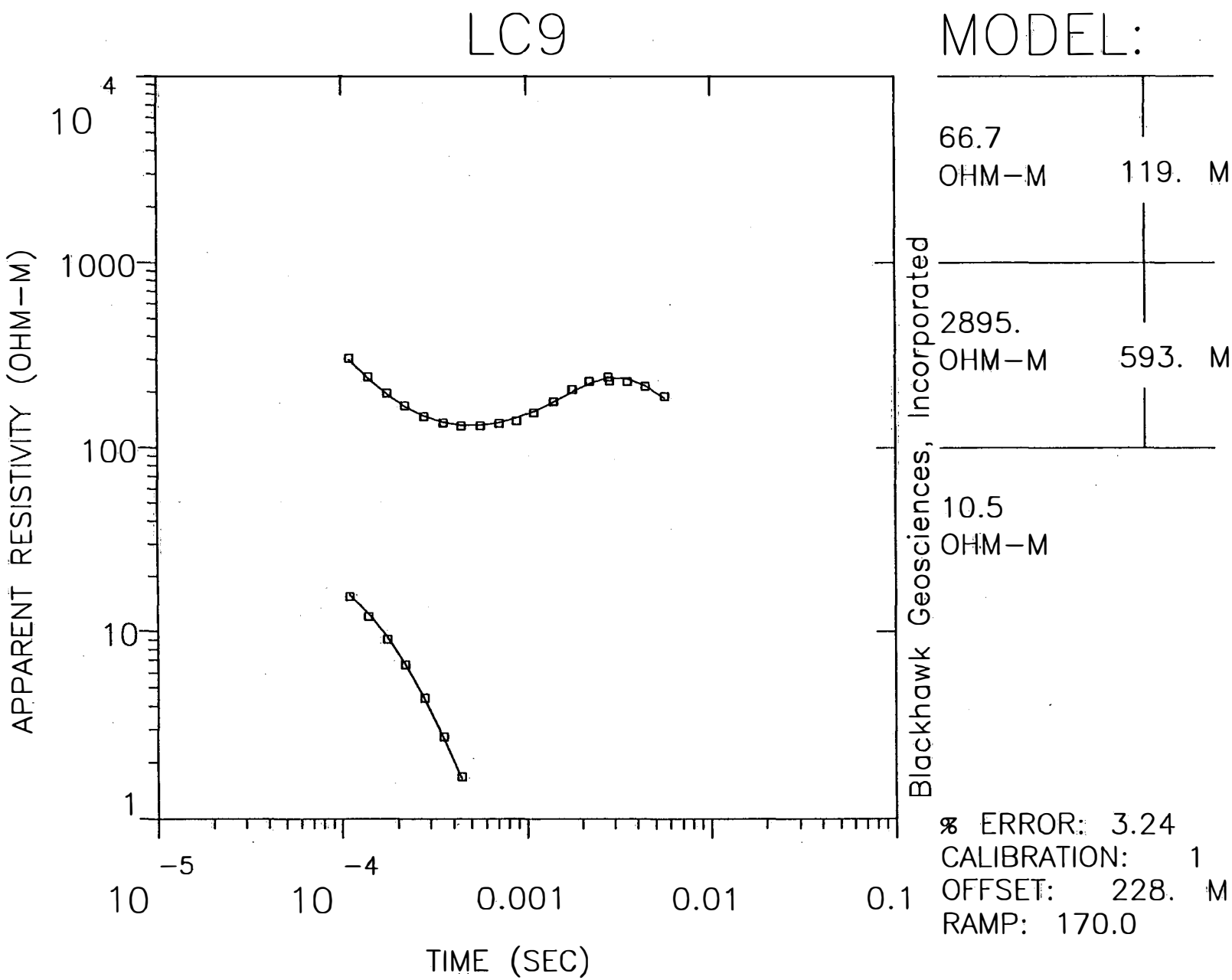
* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.94				
P 2	-0.06	0.05			
P 3	0.07	-0.04	0.63		
T 1	-0.08	-0.16	0.10	0.87	
T 2	0.01	0.03	-0.03	0.02	0.99
	P 1	P 2	P 3	T 1	T 2

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	66.136	77.586	87.421
	2	924.231	1377.570	2546.681
	3	3.773	4.749	5.829
THICK	1	50.757	63.421	75.728
	2	369.360	386.267	400.996
DEPTH	1	50.757	63.421	75.728
	2	445.088	449.689	455.386


LC9
MODEL:
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
66.7
OHM-M
119. M
2895.
OHM-M
593. M
10.5
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 3.24
CALIBRATION: 1
OFFSET: 228. M
RAMP: 170.0

LC9

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		533.1	1749.0		
66.67	119.1	414.0	1358.2	1.8	1.8
2895.00	593.1	-179.2	-587.8	0.2	2.0
10.50					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	1.10E-04	3.04E+02	2.99E+02	1.347	
2	1.40E-04	2.41E+02	2.35E+02	2.379	
3	1.77E-04	1.96E+02	1.93E+02	1.476	
4	2.20E-04	1.68E+02	1.67E+02	0.704	
5	2.80E-04	1.47E+02	1.48E+02	-0.669	
6	3.55E-04	1.36E+02	1.37E+02	-1.135	
7	4.43E-04	1.31E+02	1.33E+02	-1.426	
8	5.64E-04	1.31E+02	1.32E+02	-1.167	
9	7.13E-04	1.36E+02	1.37E+02	-0.893	
10	8.81E-04	1.40E+02	1.45E+02	-3.612	
11	1.10E-03	1.54E+02	1.57E+02	-1.950	
12	1.40E-03	1.77E+02	1.77E+02	-0.202	
13	1.41E-03	1.78E+02	1.78E+02	0.295	
14	1.77E-03	2.07E+02	2.00E+02	3.433	
15	1.80E-03	2.06E+02	2.02E+02	2.317	
16	2.20E-03	2.30E+02	2.22E+02	3.341	
17	2.22E-03	2.27E+02	2.23E+02	1.905	
18	2.80E-03	2.41E+02	2.38E+02	1.260	
19	2.85E-03	2.29E+02	2.38E+02	-3.805	
20	3.55E-03	2.28E+02	2.35E+02	-3.272	
21	4.43E-03	2.14E+02	2.16E+02	-0.731	
22	5.64E-03	1.90E+02	1.85E+02	2.593	

R: 228. X: 0. Y: 229. DL: 457. REQ: 254. CF: 1.0000
CLHZ ARRAY, 22 DATA POINTS, RAMP: 170.0 MICROSEC, DATA: LC9
3010 LC 900NZ OPR XTL L 6 12+100 2
Ch.21 = 0.17 Ch.22 = 0.89 Ch.23 = 11 Ch.24 = 20
RMS LOG ERROR: 1.38E-02, ANTILOG YIELDS 3.2377 %
LATE TIME PARAMETERS

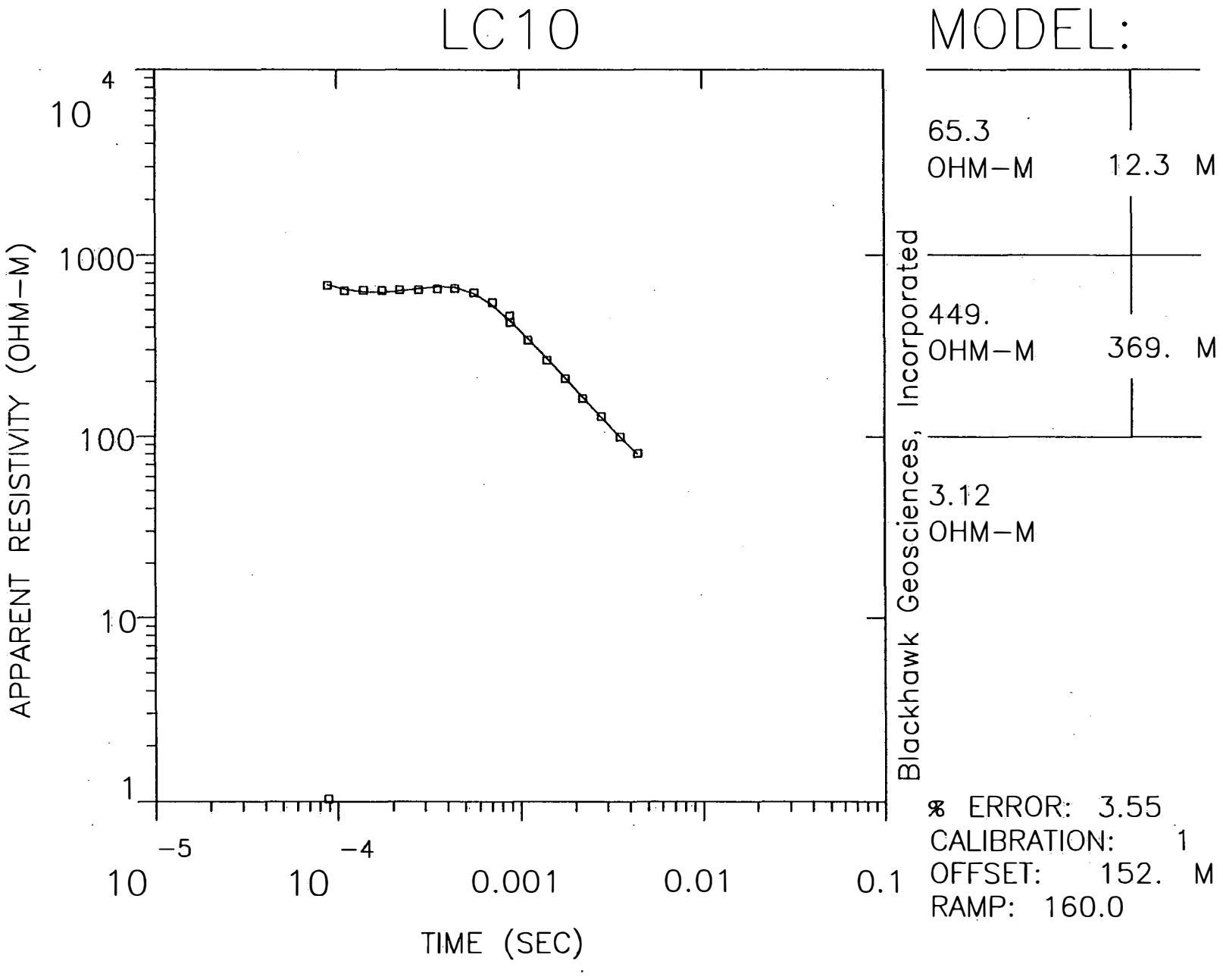
* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2
P 1	0.99				
P 2	-0.01	0.01			
P 3	0.02	-0.03	0.19		
T 1	-0.02	-0.04	0.06	0.97	
T 2	0.00	0.01	-0.04	0.00	0.99

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

LAYER		MINIMUM	BEST	MAXIMUM
RHO	1	62.799	66.670	70.606
	2	1417.458	2894.996	9154.781
	3	5.242	10.500	20.495
THICK	1	109.065	119.123	130.472
	2	563.855	593.143	618.159
DEPTH	1	109.065	119.123	130.472
	2	685.436	712.267	735.315


LC10
MODEL:
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
65.3
OHM-M
12.3 M
449.
OHM-M
369. M
3.12
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 3.55
CALIBRATION: 1
OFFSET: 152. M
RAMP: 160.0

LC10

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		363.9	1194.0		
65.32	12.3	351.6	1153.6	0.2	0.2
448.67	369.0	-17.4	-57.1	0.8	1.0
3.12					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	6.80E+02	6.84E+02	-0.568	
2	1.10E-04	6.36E+02	6.50E+02	-2.145	
3	1.40E-04	6.39E+02	6.27E+02	1.954	
4	1.77E-04	6.38E+02	6.23E+02	2.478	
5	2.20E-04	6.44E+02	6.32E+02	1.894	
6	2.80E-04	6.43E+02	6.53E+02	-1.586	
7	3.55E-04	6.51E+02	6.71E+02	-2.942	
8	4.43E-04	6.56E+02	6.66E+02	-1.434	
9	5.64E-04	6.20E+02	6.15E+02	0.821	
10	7.13E-04	5.48E+02	5.27E+02	3.949	
11	8.81E-04	4.62E+02	4.36E+02	5.805	
12	8.90E-04	4.25E+02	4.32E+02	-1.581	
13	1.10E-03	3.39E+02	3.48E+02	-2.608	
14	1.40E-03	2.63E+02	2.69E+02	-2.217	
15	1.77E-03	2.07E+02	2.08E+02	-0.436	
16	2.20E-03	1.61E+02	1.65E+02	-2.315	
17	2.80E-03	1.29E+02	1.28E+02	0.920	
18	3.55E-03	9.92E+01	9.99E+01	-0.708	
19	4.43E-03	8.09E+01	7.99E+01	1.282	

R: 152. X: 0. Y: 153. DL: 305. REQ: 170. CF: 1.0000
CLHZ ARRAY, 19 DATA POINTS, RAMP: 160.0 MICROSEC, DATA: LC10
3010 LC 1000NZ OPR XTL L 6 12+100
Ch.21 = 0.16 Ch.22 = 0.89 Ch.23 = 15 Ch.24 = 93
RMS LOG ERROR: 1.51E-02, ANTILOG YIELDS 3.5462 %
LATE TIME PARAMETERS

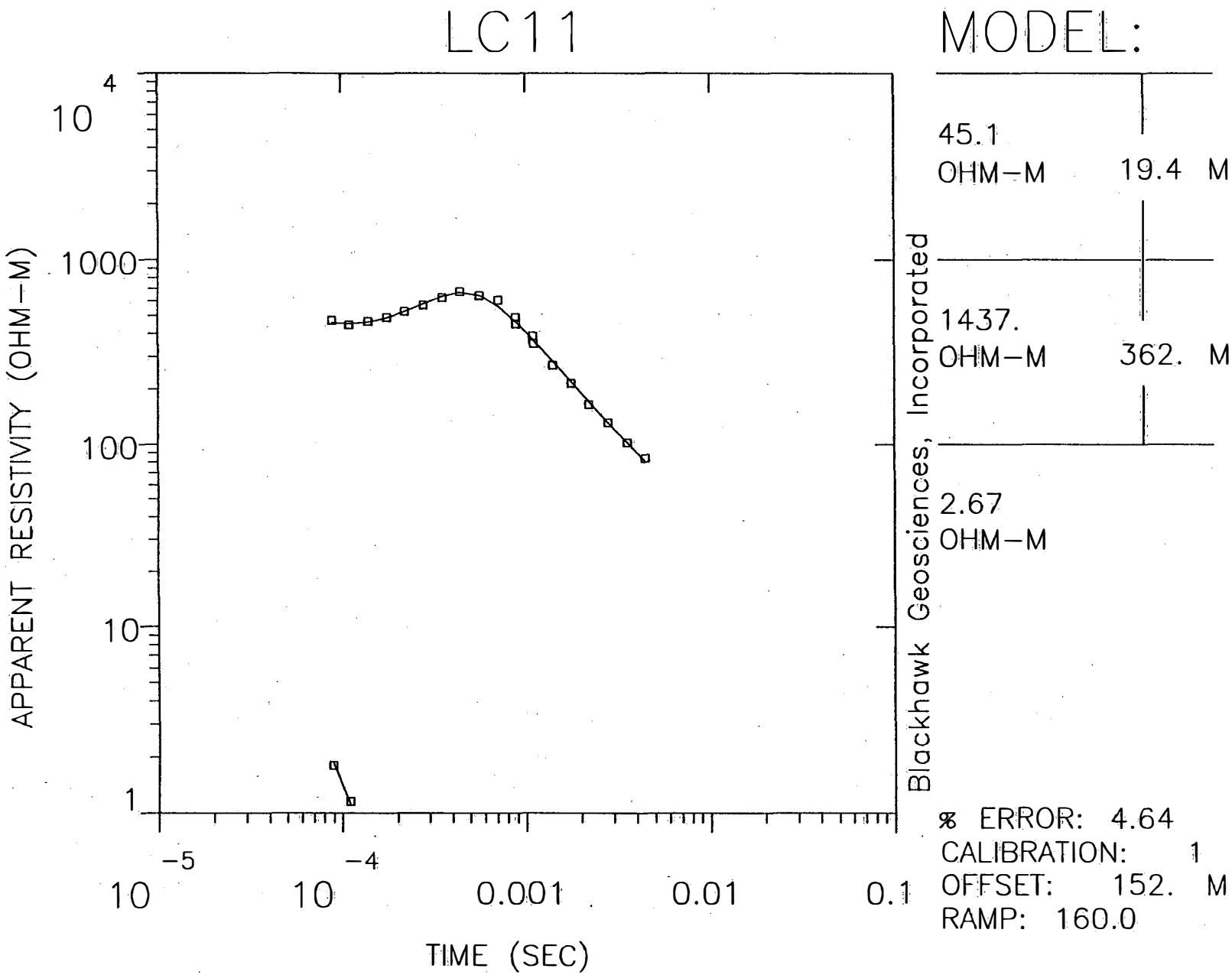
* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.51				
P 2	0.06	0.90			
P 3	0.06	-0.10	0.71		
T 1	-0.44	-0.09	-0.05	0.39	
T 2	0.02	0.00	-0.02	0.02	1.00
	P 1	P 2	P 3	T 1	T 2

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	36.429	65.320	96.555
	2	403.650	448.667	511.177
	3	2.465	3.116	3.774
THICK	1	7.266	12.319	19.644
	2	356.737	369.006	379.338
DEPTH	1	7.266	12.319	19.644
	2	372.880	381.326	389.217


LC11
MODEL:
APPARENT RESISTIVITY (OHM-M)
10 4
1000
100
10
1
10 -5
10 -4
0.001
0.01
0.1
TIME (SEC)
45.1
OHM-M
19.4 M
1437.
OHM-M
362. M
2.67
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 4.64
CALIBRATION: 1
OFFSET: 152. M
RAMP: 160.0

LC11

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		360.0	1181.0		
45.06	19.4	340.6	1117.5	0.4	0.4
1436.98	362.0	-21.4	-70.3	0.3	0.7
2.67					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	4.69E+02	4.58E+02	2.382	
2	1.10E-04	4.44E+02	4.53E+02	-1.894	
3	1.40E-04	4.64E+02	4.62E+02	0.552	
4	1.77E-04	4.89E+02	4.86E+02	0.563	
5	2.20E-04	5.24E+02	5.22E+02	0.316	
6	2.80E-04	5.68E+02	5.76E+02	-1.371	
7	3.55E-04	6.22E+02	6.33E+02	-1.701	
8	4.43E-04	6.71E+02	6.65E+02	0.992	
9	5.64E-04	6.40E+02	6.42E+02	-0.303	
10	7.13E-04	6.03E+02	5.60E+02	7.694	
11	8.81E-04	4.87E+02	4.64E+02	4.859	
12	8.90E-04	4.49E+02	4.59E+02	-2.205	
13	1.10E-03	3.87E+02	3.69E+02	4.869	
14	1.10E-03	3.53E+02	3.68E+02	-3.954	
15	1.40E-03	2.69E+02	2.82E+02	-4.573	
16	1.77E-03	2.14E+02	2.17E+02	-1.549	
17	2.20E-03	1.65E+02	1.71E+02	-3.499	
18	2.80E-03	1.31E+02	1.31E+02	-0.049	
19	3.55E-03	1.02E+02	1.02E+02	-0.298	
20	4.43E-03	8.35E+01	8.11E+01	2.934	

R: 152. X: 0. Y: 153. DL: 305. REQ: 170. CF: 1.0000
CLHZ ARRAY, 20 DATA POINTS, RAMP: 160.0 MICROSEC, DATA: LC11
3010 LC 1100NZ OPR XTL L 6 12+100
Ch.21 = 0.16 Ch.22 = 0.89 Ch.23 = 15 Ch.24 = 93
RMS LOG ERROR: 1.97E-02, ANTILOG YIELDS 4.6371 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

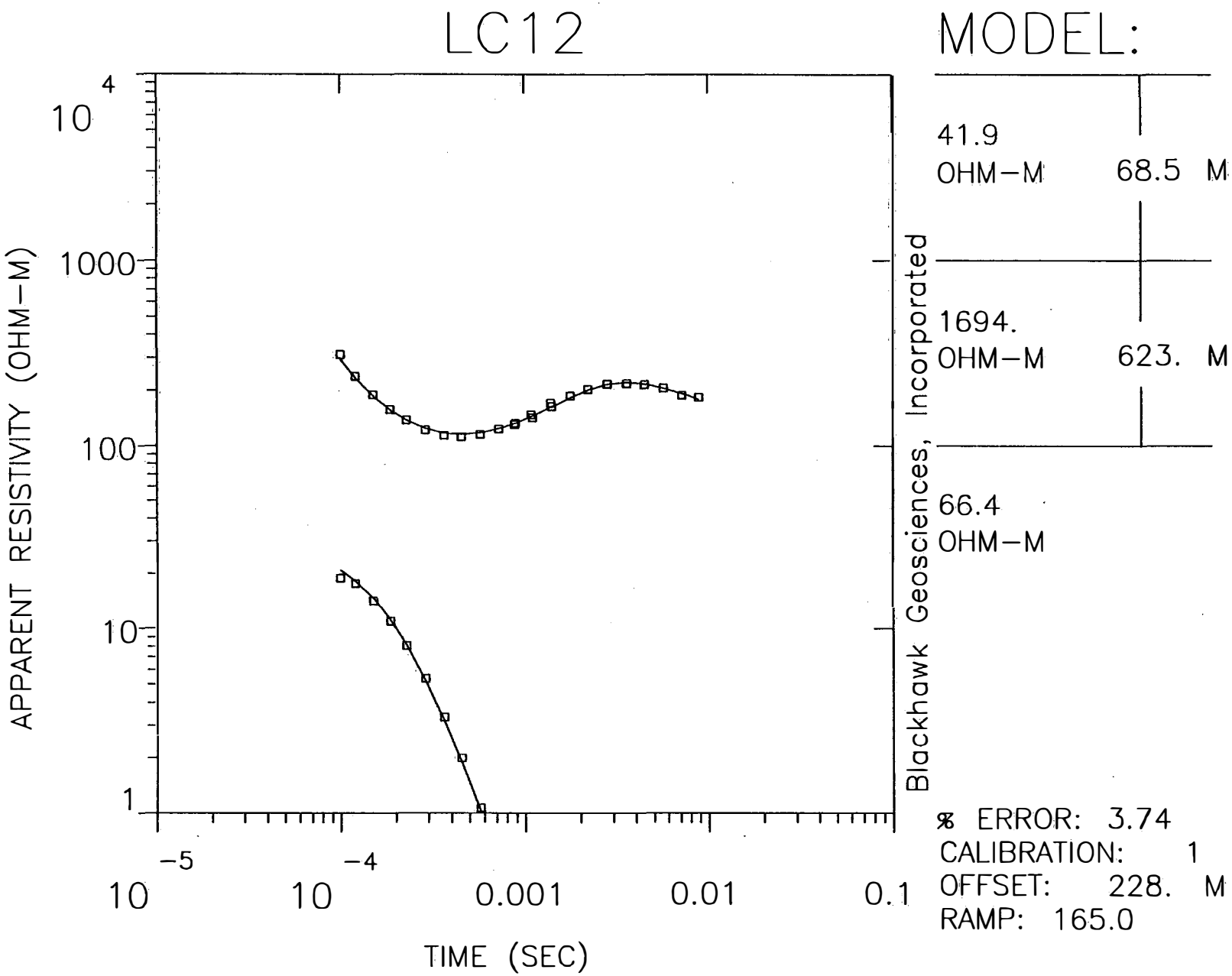
PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.74				
P 2	-0.09	0.17			
P 3	0.13	-0.09	0.52		
T 1	-0.29	-0.22	0.15	0.65	
T 2	0.02	0.01	-0.04	0.03	0.99
	P 1	P 2	P 3	T 1	T 2

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

LAYER	MINIMUM	BEST	MAXIMUM

RHO	1	32.365	45.059	62.731
	2	1104.120	1436.977	2433.978
	3	1.587	2.672	3.582
THICK	1	13.014	19.368	28.826
	2	339.180	362.038	375.563
DEPTH	1	13.014	19.368	28.826
	2	366.430	381.406	391.548


LC12
MODEL:
APPARENT RESISTIVITY (OHM-M)
10 4
1000
100
10
1
10 -5
10 -4
0.001
0.01
0.1
TIME (SEC)
41.9
OHM-M
68.5 M
1694.
OHM-M
623. M
66.4
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 3.74
CALIBRATION: 1
OFFSET: 228. M
RAMP: 165.0

LC12

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		480.1	1575.0		
41.92	68.5	411.6	1350.3	1.6	1.6
1693.64	622.5	-211.0	-692.2	0.4	2.0
66.43					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	1.00E-04	3.12E+02	2.92E+02	6.976	
2	1.21E-04	2.38E+02	2.33E+02	1.857	
3	1.51E-04	1.90E+02	1.86E+02	1.907	
4	1.87E-04	1.58E+02	1.56E+02	0.846	
5	2.29E-04	1.38E+02	1.38E+02	0.314	
6	2.90E-04	1.22E+02	1.24E+02	-1.837	
7	3.66E-04	1.14E+02	1.17E+02	-2.802	
8	4.54E-04	1.12E+02	1.15E+02	-2.928	
9	5.74E-04	1.15E+02	1.17E+02	-2.143	
10	7.19E-04	1.23E+02	1.23E+02	-0.467	
11	8.80E-04	1.30E+02	1.32E+02	-1.506	
12	8.90E-04	1.32E+02	1.33E+02	-0.108	
13	1.08E-03	1.47E+02	1.44E+02	2.305	
14	1.10E-03	1.42E+02	1.45E+02	-2.221	
15	1.38E-03	1.71E+02	1.62E+02	5.778	
16	1.40E-03	1.63E+02	1.63E+02	0.304	
17	1.77E-03	1.87E+02	1.83E+02	2.238	
18	2.20E-03	2.03E+02	2.01E+02	1.132	
19	2.80E-03	2.18E+02	2.16E+02	0.797	
20	3.55E-03	2.18E+02	2.21E+02	-1.351	
21	4.43E-03	2.15E+02	2.18E+02	-1.046	
22	5.64E-03	2.06E+02	2.06E+02	-0.198	
23	7.13E-03	1.88E+02	1.92E+02	-2.039	
24	8.81E-03	1.83E+02	1.79E+02	2.758	

R: 228. X: 0. Y: 229. DL: 457. REQ: 254. CF: 1.0000
CLHZ ARRAY, 24 DATA POINTS, RAMP: 165.0 MICROSEC, DATA: LC12
3110 LC 1200NZ OPR XTL L 6 12+100
Ch.21 = 0.165 Ch.22 = 0.89 Ch.23 = 11 Ch.24 = 2
RMS LOG ERROR: 1.60E-02, ANTILOG YIELDS 3.7443 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

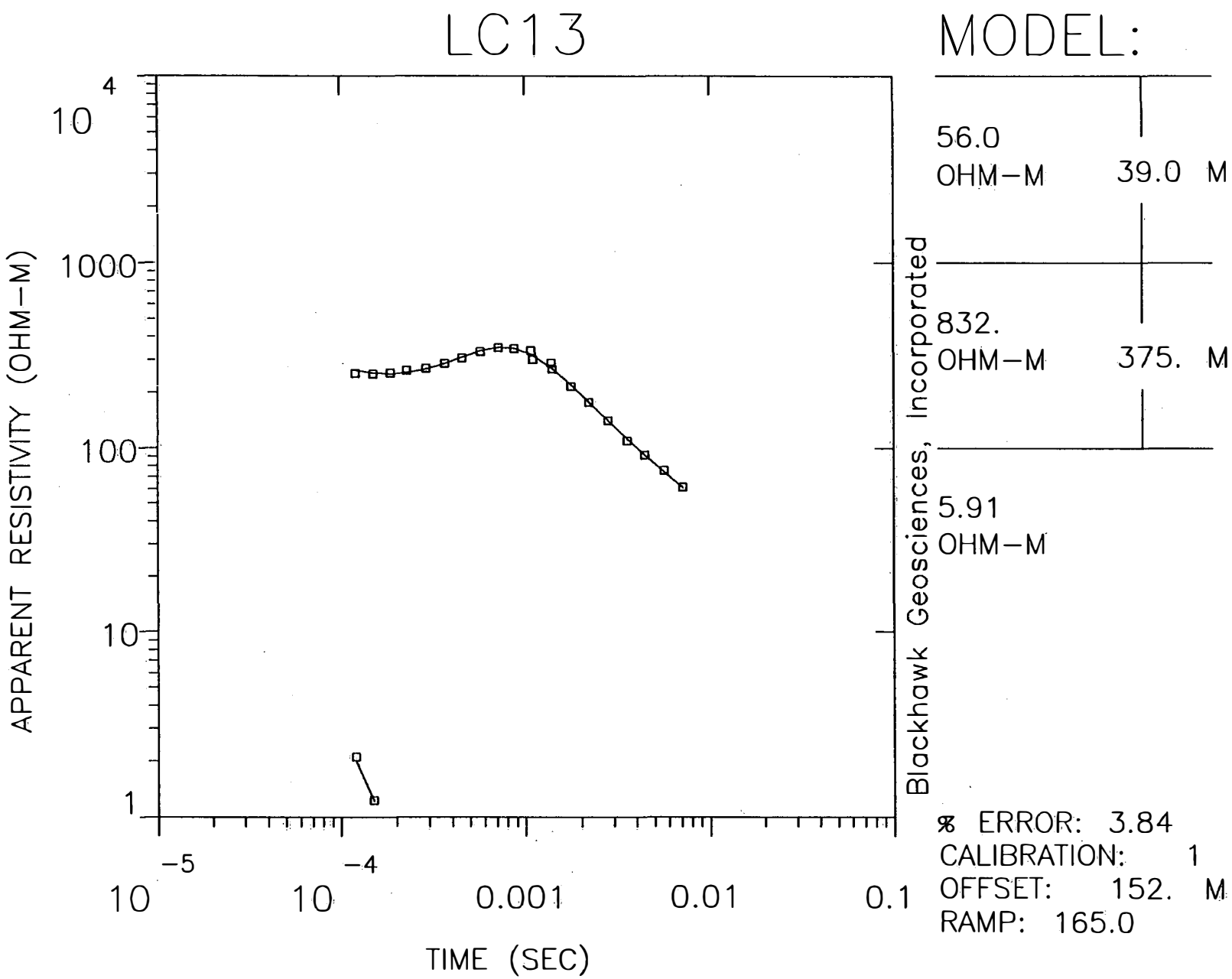
PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.97			
P 2	-0.04	0.07		
P 3	0.03	-0.07	0.55	
T 1	-0.04	-0.10	0.04	0.94

T 2 -0.01 0.07 0.12 -0.01 0.96
P 1 P 2 P 3 T 1 T 2

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	36.679	41.922	47.718
	2	989.134	1693.642	3515.415
	3	47.488	66.429	99.326
THICK	1	57.176	68.486	82.116
	2	540.312	622.550	678.968
DEPTH	1	57.176	68.486	82.116
	2	606.655	691.035	748.865


LC13
MODEL:
APPARENT RESISTIVITY (OHM-M)
10 4
1000
100
10
1
10 -5
10 -4
0.001
0.01
0.1
TIME (SEC)
56.0
OHM-M
39.0 M
832.
OHM-M
375. M
5.91
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 3.84
CALIBRATION: 1
OFFSET: 152. M
RAMP: 165.0

LC13

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		384.0	1260.0		
55.98	39.0	345.0	1132.0	0.7	0.7
832.01	374.9	-29.9	-98.1	0.5	1.1
5.91					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	1.21E-04	2.53E+02	2.63E+02	-3.695	
2	1.51E-04	2.51E+02	2.53E+02	-0.813	
3	1.87E-04	2.54E+02	2.51E+02	1.420	
4	2.29E-04	2.63E+02	2.55E+02	3.352	
5	2.90E-04	2.69E+02	2.67E+02	0.764	
6	3.66E-04	2.86E+02	2.86E+02	0.161	
7	4.54E-04	3.07E+02	3.09E+02	-0.651	
8	5.74E-04	3.32E+02	3.35E+02	-0.805	
9	7.19E-04	3.48E+02	3.50E+02	-0.506	
10	8.80E-04	3.44E+02	3.46E+02	-0.334	
11	1.08E-03	3.35E+02	3.20E+02	4.716	
12	1.10E-03	3.00E+02	3.17E+02	-5.131	
13	1.38E-03	2.89E+02	2.71E+02	6.489	
14	1.40E-03	2.68E+02	2.68E+02	0.094	
15	1.77E-03	2.15E+02	2.18E+02	-1.409	
16	2.20E-03	1.77E+02	1.78E+02	-0.430	
17	2.80E-03	1.41E+02	1.41E+02	-0.368	
18	3.55E-03	1.10E+02	1.13E+02	-2.950	
19	4.43E-03	9.19E+01	9.23E+01	-0.373	
20	5.64E-03	7.57E+01	7.45E+01	1.582	
21	7.13E-03	6.15E+01	6.11E+01	0.587	

R: 152. X: 0. Y: 153. DL: 305. REQ: 170. CF: 1.0000
CLHZ ARRAY, 21 DATA POINTS, RAMP: 165.0 MICROSEC, DATA: LC13
3110 LC 1300NZ OPR XTL L 6 12+100
Ch.21 = 0.165 Ch.22 = 0.89 Ch.23 = 15 Ch.24 = 9
RMS LOG ERROR: 1.64E-02, ANTILOG YIELDS 3.8399 %
LATE TIME PARAMETERS

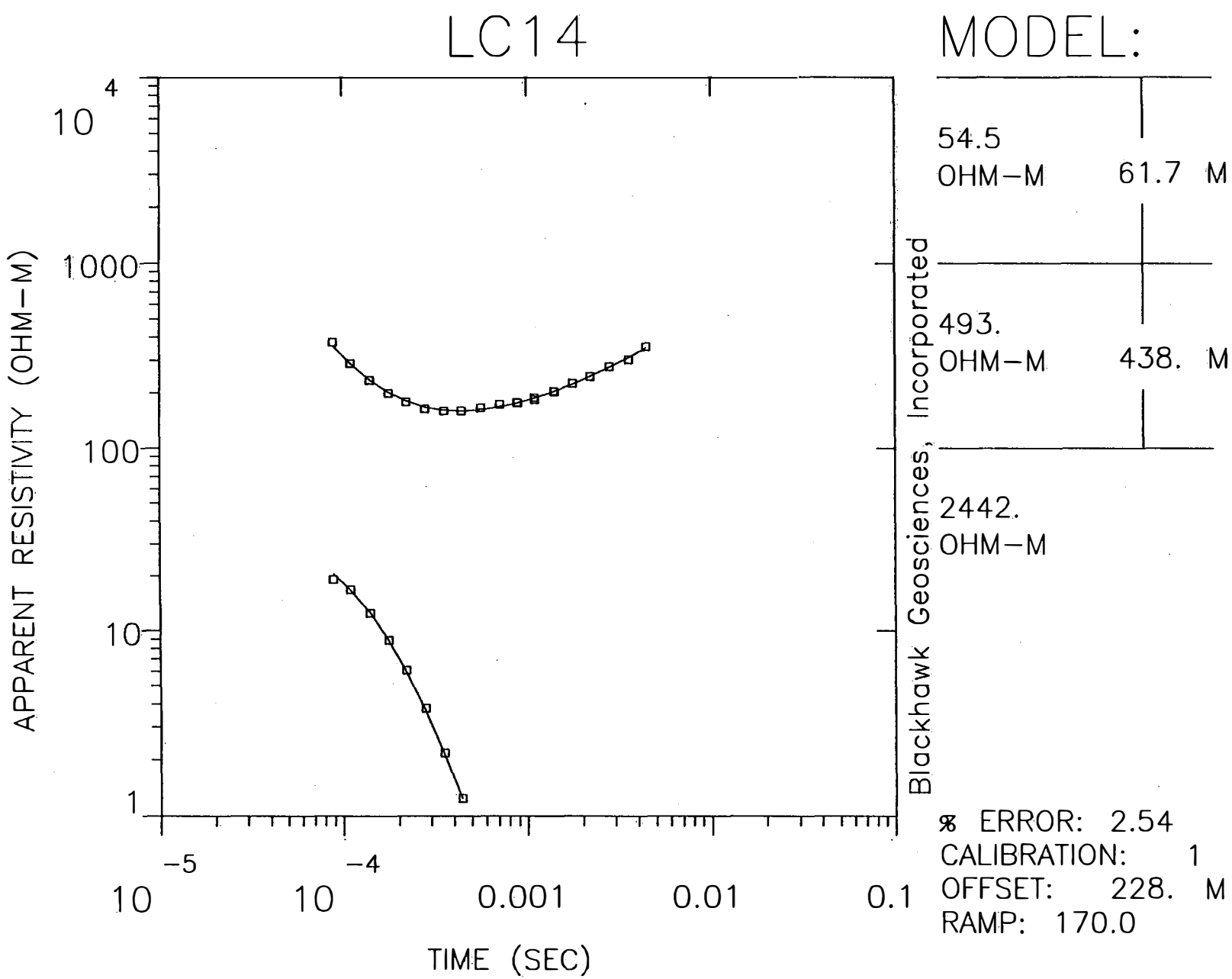
* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2
P 1	0.84				
P 2	-0.14	0.22			
P 3	0.08	-0.06	0.75		
T 1	-0.22	-0.29	0.09	0.68	
T 2	0.02	0.04	-0.01	0.03	1.00

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	39.640	55.982	75.104
	2	614.151	832.013	1397.015
	3	4.548	5.907	7.566
THICK	1	24.500	39.016	60.775
	2	351.792	374.934	393.226
DEPTH	1	24.500	39.016	60.775
	2	412.568	413.950	418.755


LC14
MODEL:
APPARENT RESISTIVITY (OHM-M)
10 4
1000
100
10
1
10 -5
10 -4
0.001
0.01
0.1
TIME (SEC)
54.5
OHM-M
61.7 M
493.
OHM-M
438. M
2442.
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 2.54
CALIBRATION: 1
OFFSET: 228. M
RAMP: 170.0

LC14

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		529.7	1738.0		
54.47	61.7	468.1	1535.7	1.1	1.1
493.10	437.9	30.1	98.9	0.9	2.0
2441.92					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	3.75E+02	3.59E+02	4.585	
2	1.10E-04	2.87E+02	2.88E+02	-0.183	
3	1.40E-04	2.34E+02	2.34E+02	-0.130	
4	1.77E-04	1.98E+02	2.01E+02	-1.075	
5	2.20E-04	1.78E+02	1.81E+02	-1.466	
6	2.80E-04	1.64E+02	1.67E+02	-2.136	
7	3.55E-04	1.59E+02	1.61E+02	-0.937	
8	4.43E-04	1.60E+02	1.59E+02	0.482	
9	5.64E-04	1.65E+02	1.62E+02	2.186	
10	7.13E-04	1.73E+02	1.68E+02	3.299	
11	8.81E-04	1.77E+02	1.76E+02	0.443	
12	8.90E-04	1.76E+02	1.76E+02	-0.099	
13	1.10E-03	1.88E+02	1.87E+02	0.170	
14	1.10E-03	1.84E+02	1.88E+02	-1.901	
15	1.40E-03	2.04E+02	2.04E+02	-0.078	
16	1.41E-03	2.02E+02	2.05E+02	-1.004	
17	1.77E-03	2.25E+02	2.24E+02	0.781	
18	2.20E-03	2.46E+02	2.46E+02	0.000	
19	2.80E-03	2.77E+02	2.76E+02	0.357	
20	3.55E-03	3.02E+02	3.11E+02	-2.651	
21	4.43E-03	3.54E+02	3.50E+02	1.233	

R: 228. X: 0. Y: 229. DL: 457. REQ: 254. CF: 1.0000
CLHZ ARRAY, 21 DATA POINTS, RAMP: 170.0 MICROSEC, DATA: LC14
0111 LC 1400NZ OPR XTL L 6 12+100 2
Ch.21 = 0.17 Ch.22 = 0.89 Ch.23 = 11 Ch.24 = 20
RMS LOG ERROR: 1.09E-02, ANTILOG YIELDS 2.5436 %
LATE TIME PARAMETERS

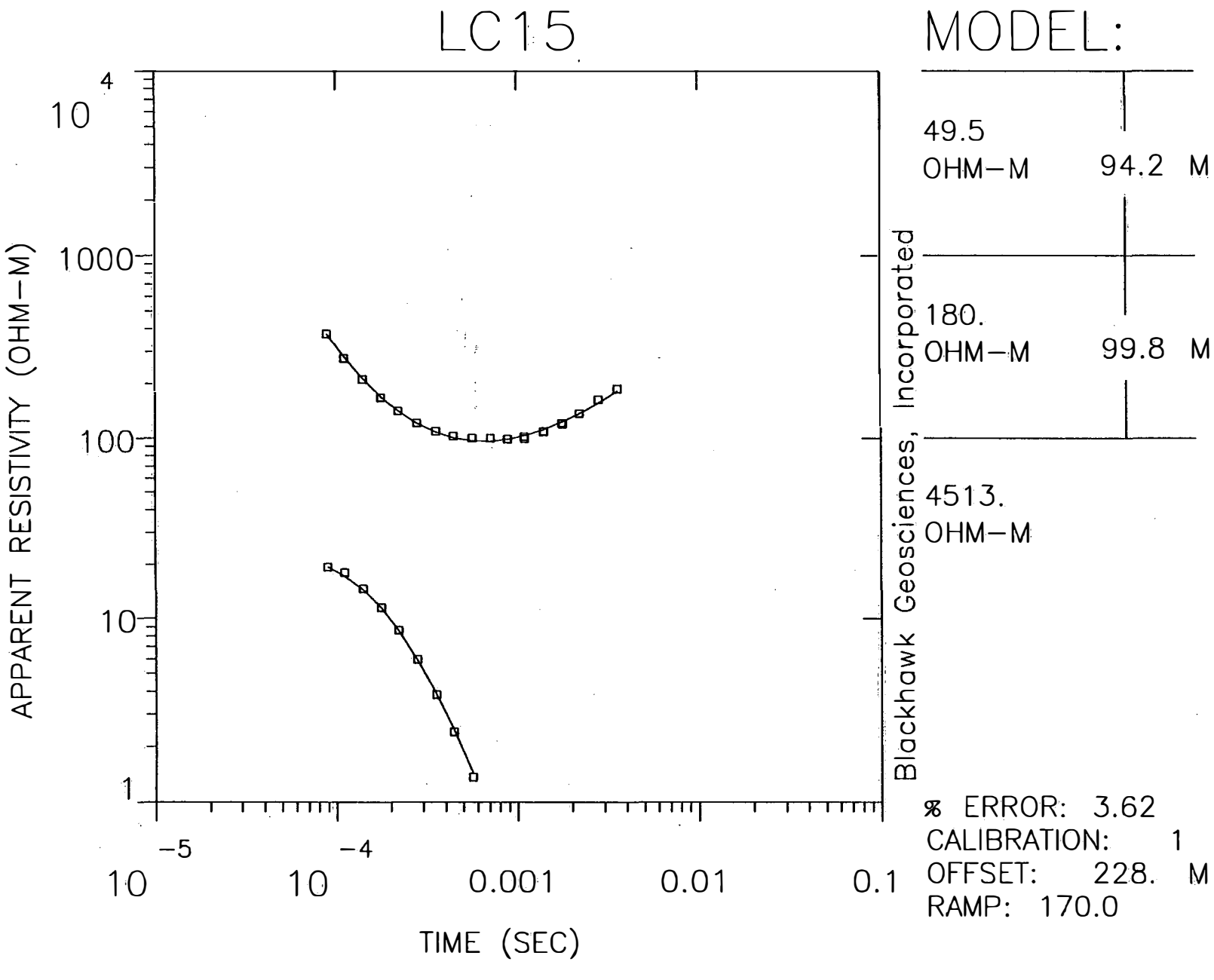
* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2
P 1	0.95				
P 2	-0.08	0.62			
P 3	0.01	0.03	0.07		
T 1	-0.09	-0.20	0.03	0.83	
T 2	-0.03	-0.32	-0.16	-0.11	0.55

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	48.514	54.465	63.169
	2	369.001	493.096	710.280
	3	1210.853	2441.916	7062.861
THICK	1	50.624	61.664	79.394
	2	290.840	437.933	733.124
DEPTH	1	50.624	61.664	79.394
	2	346.789	499.596	802.818


LC15
MODEL:
APPARENT RESISTIVITY (OHM-M)
10 4
1000
100
10
1
10 -5
10 -4
0.001
0.01
0.1
TIME (SEC)
49.5
OHM-M
94.2 M
180.
OHM-M
99.8 M
4513.
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 3.62
CALIBRATION: 1
OFFSET: 228. M
RAMP: 170.0

LC15

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		477.9	1568.0		
49.51	94.2	383.8	1259.1	1.9	1.9
180.42	99.8	284.0	931.6	0.6	2.5
4512.81					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	3.75E+02	3.73E+02	0.440	
2	1.10E-04	2.75E+02	2.83E+02	-2.757	
3	1.40E-04	2.12E+02	2.14E+02	-1.054	
4	1.77E-04	1.68E+02	1.69E+02	-0.811	
5	2.20E-04	1.41E+02	1.41E+02	-0.030	
6	2.80E-04	1.21E+02	1.21E+02	0.095	
7	3.55E-04	1.09E+02	1.08E+02	1.075	
8	4.43E-04	1.03E+02	1.01E+02	2.292	
9	5.64E-04	1.00E+02	9.67E+01	3.639	
10	7.13E-04	1.00E+02	9.63E+01	3.783	
11	8.81E-04	9.87E+01	9.85E+01	0.231	
12	8.90E-04	9.86E+01	9.87E+01	-0.024	
13	1.10E-03	1.02E+02	1.03E+02	-1.154	
14	1.10E-03	9.94E+01	1.03E+02	-3.840	
15	1.40E-03	1.08E+02	1.12E+02	-3.075	
16	1.41E-03	1.09E+02	1.12E+02	-2.583	
17	1.77E-03	1.21E+02	1.23E+02	-1.300	
18	1.80E-03	1.19E+02	1.24E+02	-3.481	
19	2.20E-03	1.37E+02	1.37E+02	-0.028	
20	2.80E-03	1.63E+02	1.57E+02	4.361	
21	3.55E-03	1.87E+02	1.82E+02	3.105	

R: 228. X: 0. Y: 229. DL: 457. REQ: 254. CF: 1.0000
CLHZ ARRAY, 21 DATA POINTS, RAMP: 170.0 MICROSEC, DATA: LC15
0111 LC 1500NZ OPR XTL L 6 12+100
Ch.21 = 0.17 Ch.22 = 0.89 Ch.23 = 11 Ch.24 = 20
RMS LOG ERROR: 1.54E-02, ANTILOG YIELDS 3.6169 %
LATE TIME PARAMETERS

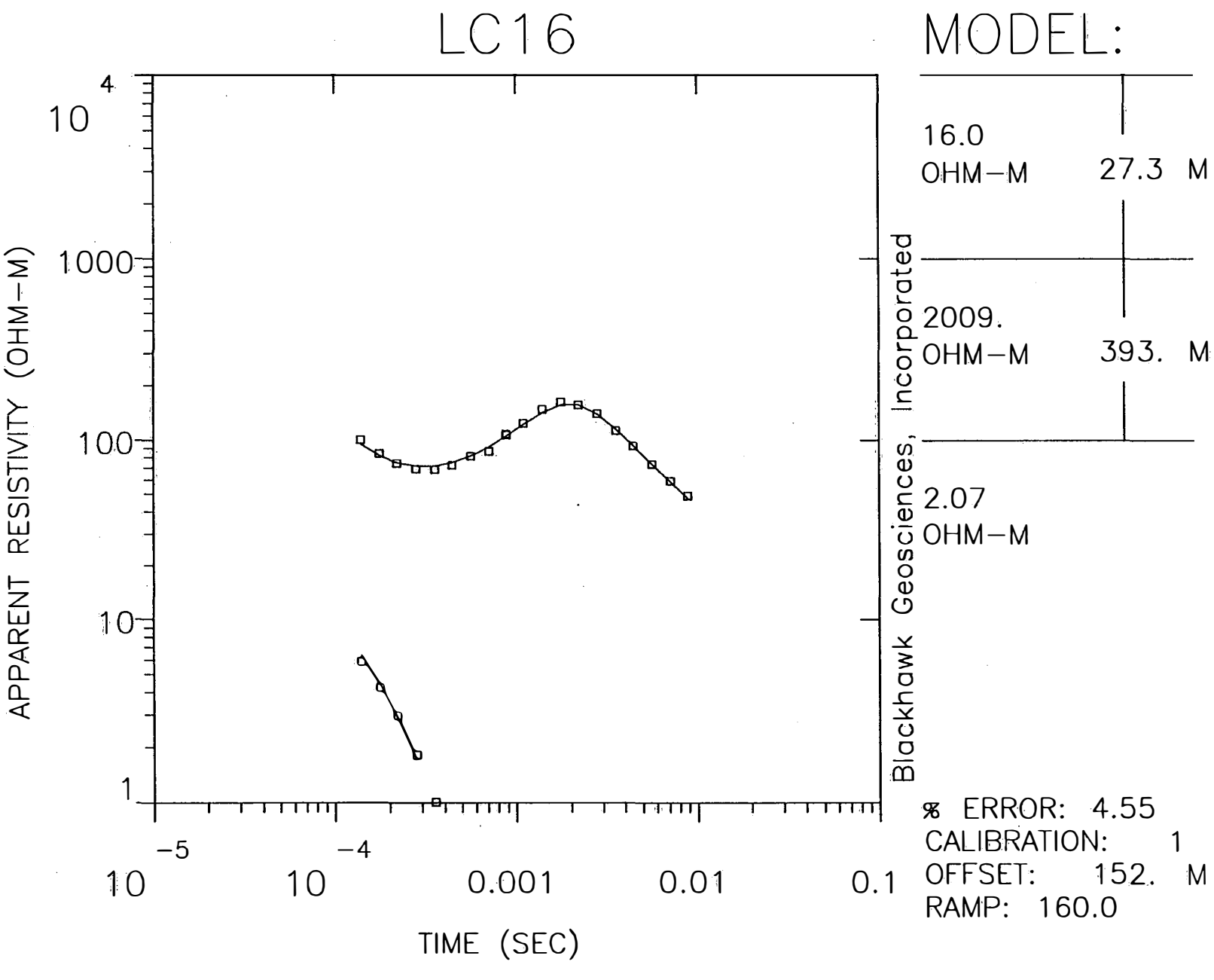
* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2
P 1	0.99				
P 2	-0.01	0.10			
P 3	0.00	0.03	0.02		
T 1	-0.02	-0.20	0.00	0.90	
T 2	0.04	-0.16	-0.07	0.13	0.33

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	45.410	49.507	53.172
	2	129.281	180.420	292.706
	3	1570.987	4512.813	14270.768
THICK	1	78.245	94.167	110.813
	2	42.251	99.807	174.700
DEPTH	1	78.245	94.167	110.813
	2	153.064	193.974	259.396


LC16
MODEL:
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
16.0
OHM-M
27.3 M
2009.
OHM-M
393. M
2.07
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 4.55
CALIBRATION: 1
OFFSET: 152. M
RAMP: 160.0

LC16

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	(FEET)	CONDUCTANCE (S) LAYER	TOTAL
		353.9	1161.0		
15.97	27.3	326.6	1071.5	1.7	1.7
2009.02	393.5	-66.9	-219.5	0.2	1.9
2.07					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	1.40E-04	1.00E+02	9.48E+01	5.853	
2	1.77E-04	8.42E+01	8.20E+01	2.713	
3	2.20E-04	7.45E+01	7.52E+01	-0.925	
4	2.80E-04	6.90E+01	7.19E+01	-3.979	
5	3.55E-04	6.90E+01	7.21E+01	-4.367	
6	4.43E-04	7.28E+01	7.53E+01	-3.297	
7	5.64E-04	8.17E+01	8.20E+01	-0.353	
8	7.13E-04	8.71E+01	9.23E+01	-5.600	
9	8.81E-04	1.08E+02	1.05E+02	3.082	
10	8.90E-04	1.07E+02	1.06E+02	1.344	
11	1.10E-03	1.24E+02	1.22E+02	1.263	
12	1.40E-03	1.48E+02	1.43E+02	3.641	
13	1.77E-03	1.62E+02	1.57E+02	3.133	
14	2.20E-03	1.57E+02	1.57E+02	-0.187	
15	2.80E-03	1.40E+02	1.40E+02	-0.150	
16	3.55E-03	1.13E+02	1.16E+02	-2.515	
17	4.43E-03	9.27E+01	9.38E+01	-1.186	
18	5.64E-03	7.36E+01	7.38E+01	-0.221	
19	7.13E-03	5.95E+01	5.85E+01	1.691	
20	8.81E-03	4.90E+01	4.76E+01	3.075	

R: 152. X: 0. Y: 153. DL: 305. REQ: 170. CF: 1.0000
CLHZ ARRAY, 20 DATA POINTS, RAMP: 160.0 MICROSEC, DATA: LC16
0211 LC 1600NZ OPR XTL L 6 12+100
Ch.21 = 0.16 Ch.22 = 0.89 Ch.23 = 15 Ch.24 = 93
RMS LOG ERROR: 1.93E-02, ANTILOG YIELDS 4.5537 %
LATE TIME PARAMETERS

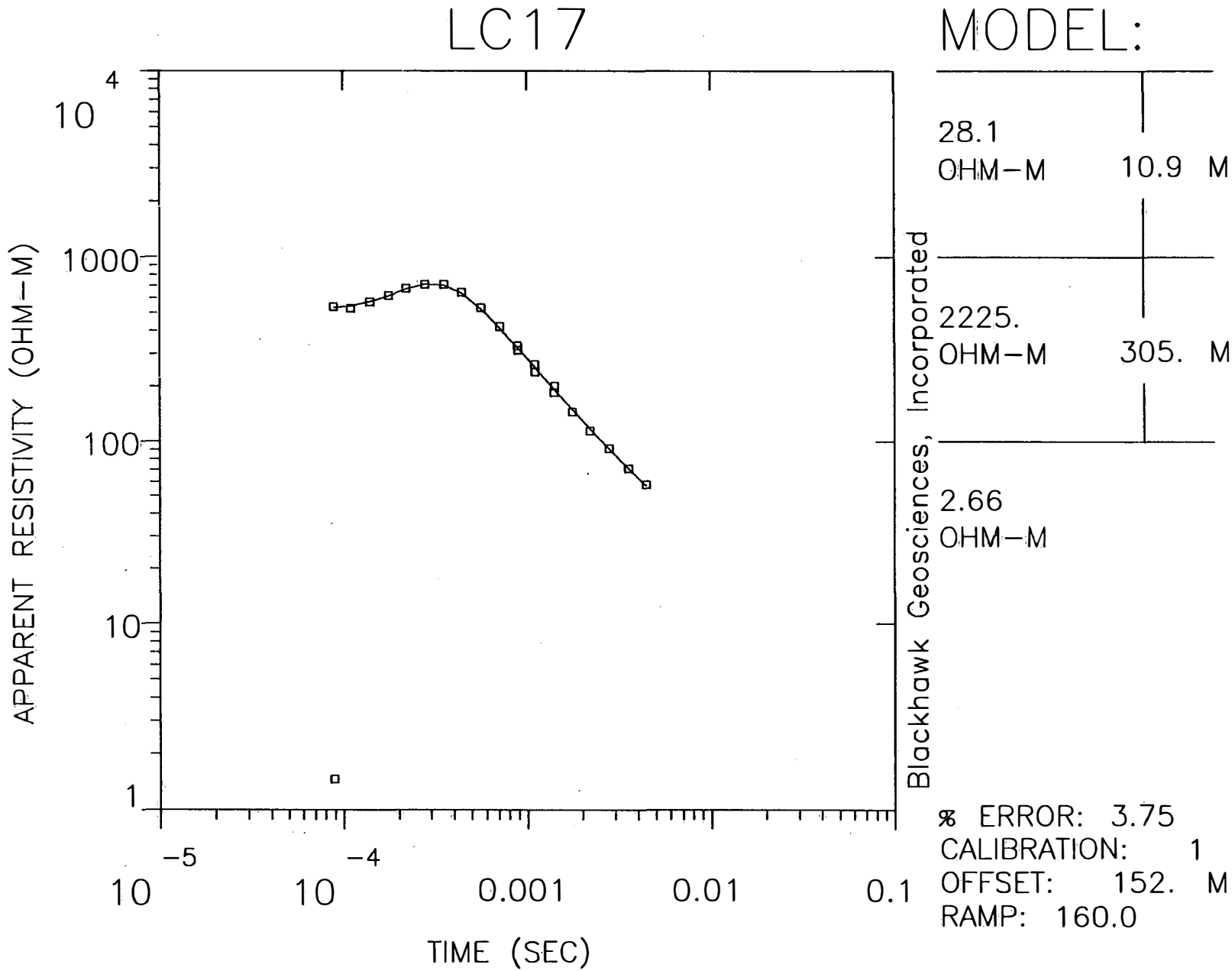
* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.91				
P 2	-0.03	0.01			
P 3	0.10	-0.02	0.34		
T 1	-0.10	-0.06	0.13	0.88	
T 2	0.01	0.01	-0.04	0.01	1.00
	P 1	P 2	P 3	T 1	T 2

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

LAYER		MINIMUM	BEST	MAXIMUM
RHO	1	11.618	15.967	19.672
	2	936.798	2009.024	6353.092
	3	1.234	2.066	3.006
THICK	1	18.834	27.274	34.945
	2	372.685	393.489	409.353
DEPTH	1	18.834	27.274	34.945
	2	404.132	420.763	433.943


LC17
MODEL:
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
28.1
OHM-M
10.9 M
2225.
OHM-M
305. M
2.66
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 3.75
CALIBRATION: 1
OFFSET: 152. M
RAMP: 160.0

LC17

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		314.9	1033.0		
28.13	10.9	304.0	997.3	0.4	0.4
2224.84	304.9	-0.9	-3.0	0.1	0.5
2.66					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	5.40E+02	5.33E+02	1.223	
2	1.10E-04	5.30E+02	5.43E+02	-2.395	
3	1.40E-04	5.72E+02	5.73E+02	-0.089	
4	1.77E-04	6.20E+02	6.19E+02	0.175	
5	2.20E-04	6.78E+02	6.70E+02	1.190	
6	2.80E-04	7.11E+02	7.13E+02	-0.212	
7	3.55E-04	7.11E+02	7.05E+02	0.839	
8	4.43E-04	6.43E+02	6.37E+02	0.899	
9	5.64E-04	5.33E+02	5.23E+02	1.942	
10	7.13E-04	4.21E+02	4.10E+02	2.488	
11	8.81E-04	3.32E+02	3.24E+02	2.435	
12	8.90E-04	3.13E+02	3.21E+02	-2.392	
13	1.10E-03	2.62E+02	2.53E+02	3.310	
14	1.10E-03	2.40E+02	2.52E+02	-4.898	
15	1.40E-03	1.85E+02	1.92E+02	-3.727	
16	1.41E-03	2.01E+02	1.91E+02	5.187	
17	1.77E-03	1.44E+02	1.48E+02	-2.789	
18	2.20E-03	1.14E+02	1.17E+02	-2.669	
19	2.80E-03	9.12E+01	9.07E+01	0.547	
20	3.55E-03	7.08E+01	7.10E+01	-0.382	
21	4.43E-03	5.79E+01	5.70E+01	1.709	

R: 152. X: 0. Y: 153. DL: 305. REQ: 170. CF: 1.0000
CLHZ ARRAY, 21 DATA POINTS, RAMP: 160.0 MICROSEC, DATA: LC17
0211 LC 1700NZ OPR XTL L 6 12+100
Ch.21 = 0.16 Ch.22 = 0.89 Ch.23 = 15 Ch.24 = 93
RMS LOG ERROR: 1.60E-02, ANTILOG YIELDS 3.7453 %
LATE TIME PARAMETERS

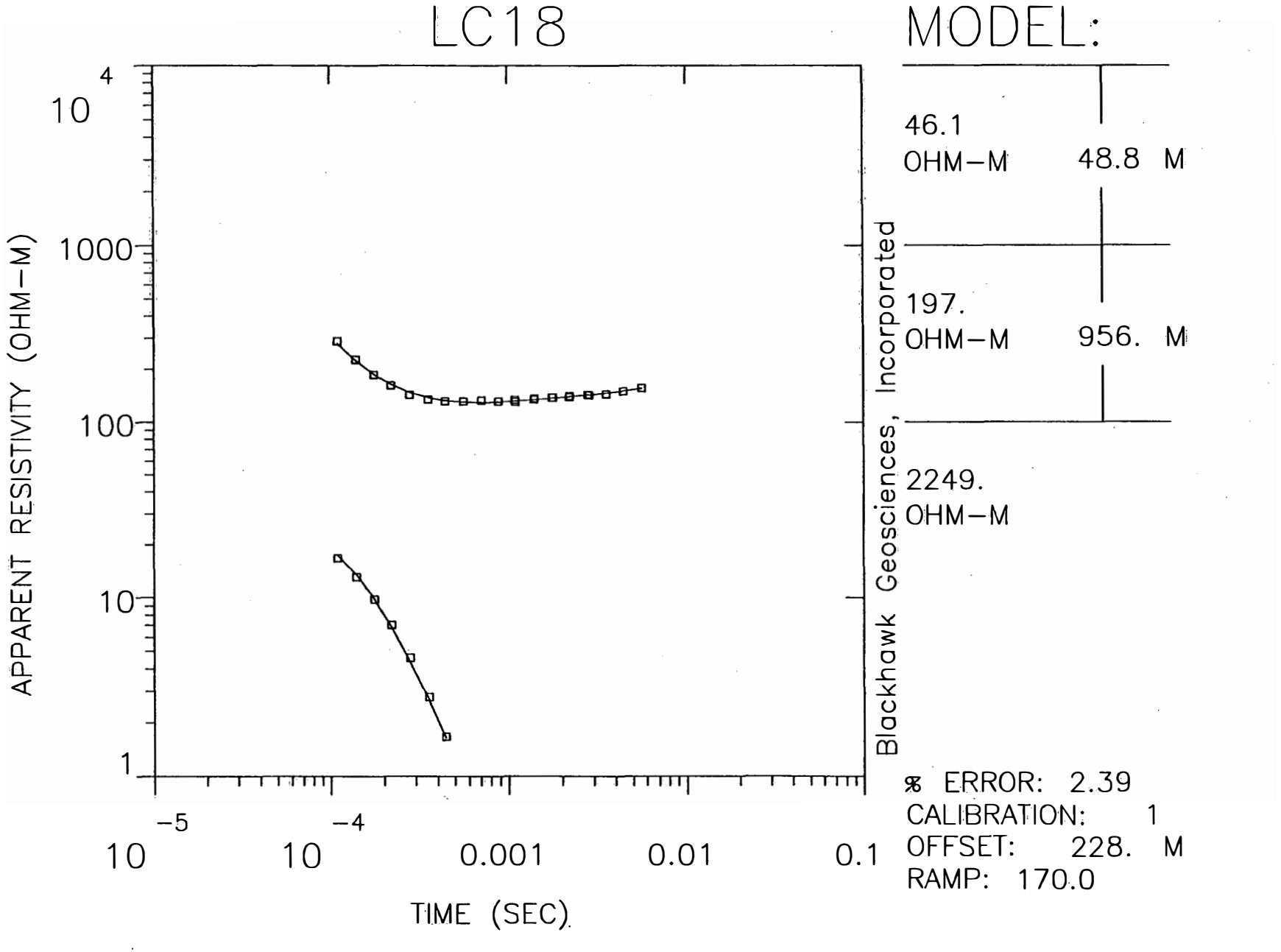
* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2
P 1	0.73				
P 2	-0.04	0.05			
P 3	0.11	-0.05	0.60		
T 1	-0.28	-0.12	0.13	0.70	
T 2	0.01	0.01	-0.03	0.02	1.00

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	18.218	28.130	40.121
	2	1440.861	2224.838	4372.527
	3	1.868	2.658	3.311
THICK	1	6.893	10.869	15.981
	2	293.759	304.896	312.020
DEPTH	1	6.893	10.869	15.981
	2	307.026	315.764	321.063


LC18
MODEL:
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
46.1
OHM-M
48.8 M
197.
OHM-M
956. M
2249.
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 2.39
CALIBRATION: 1
OFFSET: 228. M
RAMP: 170.0

LC18

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		453.8	1489.0		
46.12	48.8	405.0	1328.9	1.1	1.1
197.00	955.9	-550.9	-1807.3	4.9	5.9
2248.93					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	1.10E-04	2.88E+02	2.80E+02	2.983	
2	1.40E-04	2.27E+02	2.23E+02	1.598	
3	1.77E-04	1.86E+02	1.87E+02	-0.641	
4	2.20E-04	1.61E+02	1.64E+02	-1.995	
5	2.80E-04	1.43E+02	1.48E+02	-3.311	
6	3.55E-04	1.35E+02	1.38E+02	-2.613	
7	4.43E-04	1.31E+02	1.33E+02	-1.116	
8	5.64E-04	1.31E+02	1.30E+02	1.284	
9	7.13E-04	1.33E+02	1.29E+02	3.203	
10	8.81E-04	1.31E+02	1.30E+02	1.377	
11	8.90E-04	1.31E+02	1.30E+02	1.184	
12	1.10E-03	1.34E+02	1.31E+02	1.760	
13	1.10E-03	1.30E+02	1.31E+02	-0.961	
14	1.40E-03	1.34E+02	1.34E+02	0.236	
15	1.41E-03	1.36E+02	1.34E+02	1.368	
16	1.77E-03	1.37E+02	1.37E+02	0.486	
17	1.80E-03	1.37E+02	1.37E+02	0.432	
18	2.20E-03	1.38E+02	1.39E+02	-0.820	
19	2.22E-03	1.40E+02	1.39E+02	0.546	
20	2.80E-03	1.43E+02	1.42E+02	0.363	
21	2.85E-03	1.42E+02	1.42E+02	-0.303	
22	3.55E-03	1.44E+02	1.46E+02	-1.279	
23	4.43E-03	1.49E+02	1.49E+02	-0.132	
24	5.64E-03	1.56E+02	1.55E+02	0.312	

R: 228. X: 0. Y: 229. DL: 457. REQ: 254. CF: 1.0000
CLHZ ARRAY, 24 DATA POINTS, RAMP: 170.0 MICROSEC, DATA: LC18
0211 LC 1800NZ OPR XTL L 6 12+100
Ch.21 = 0.17 Ch.22 = 0.89 Ch.23 = 11 Ch.24 = 20
RMS LOG ERROR: 1.02E-02, ANTILOG YIELDS 2.3864 %
LATE TIME PARAMETERS

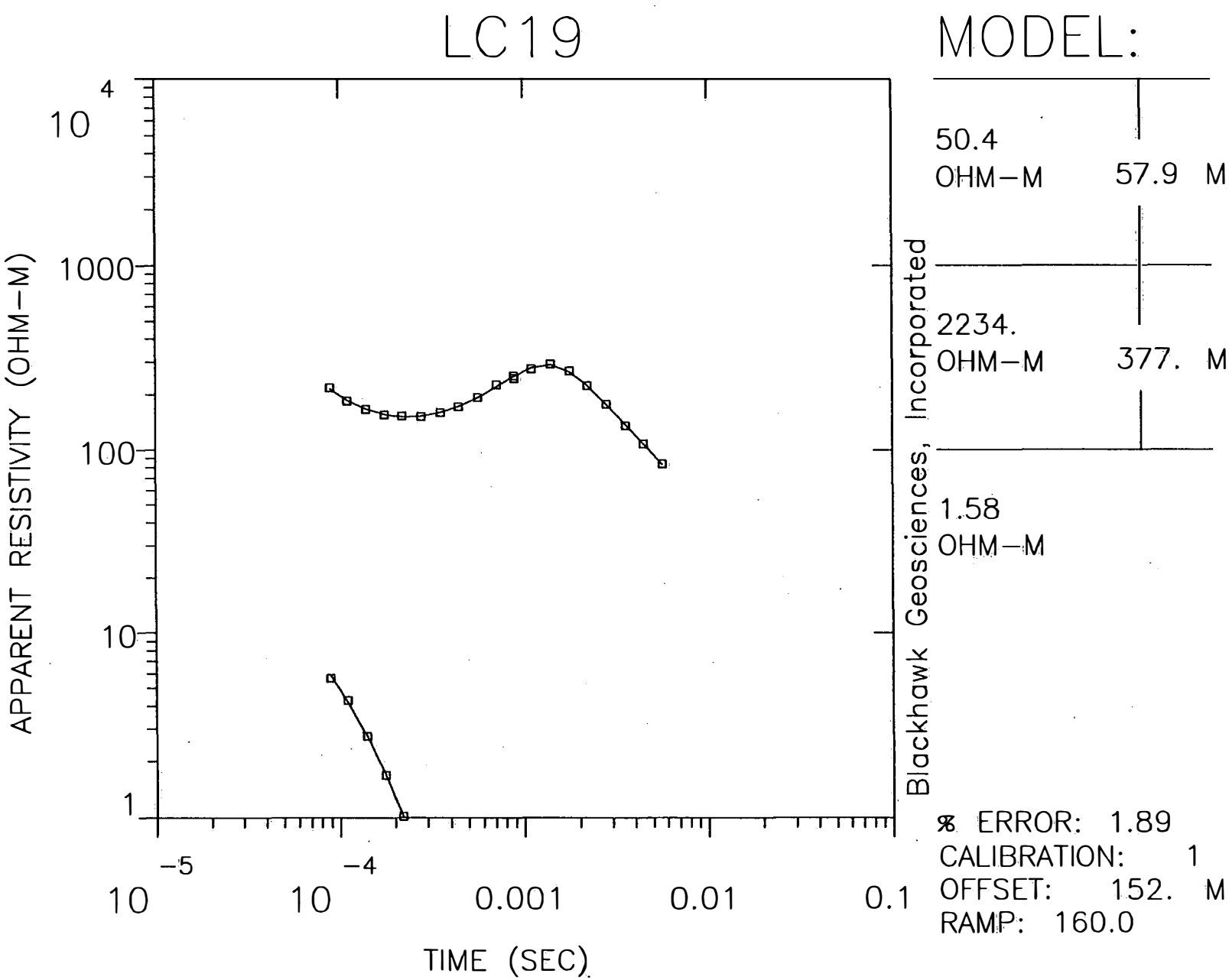
* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER
P 1 1.00
P 2 0.00 1.00
P 3 0.00 0.00 0.02
T 1 0.00 0.00 -0.01 1.00

```
T 2  0.00  0.00 -0.03  0.00  0.99
       P 1   P 2   P 3   T 1   T 2
```

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	39.518	46.124	53.048
	2	187.279	197.001	208.960
	3	144.798	2248.933	22489.328
THICK	1	37.540	48.803	61.951
	2	769.167	955.897	1490.209
DEPTH	1	37.540	48.803	61.951
	2	815.852	1004.700	1543.642



MODEL:

50.4 OHM-M

57.9 M

2234. OHM-M

377. M

1.58 OHM-M

Blackhawk Geosciences, Incorporated

% ERROR: 1.89
CALIBRATION: 1
OFFSET: 152. M
RAMP: 160.0

LC19

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		378.0	1240.0		
50.35	57.9	320.0	1049.9	1.2	1.2
2234.36	376.5	-56.5	-185.3	0.2	1.3
1.58					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	2.19E+02	2.14E+02	2.100	
2	1.10E-04	1.84E+02	1.87E+02	-1.475	
3	1.40E-04	1.67E+02	1.67E+02	-0.237	
4	1.77E-04	1.56E+02	1.56E+02	-0.389	
5	2.20E-04	1.53E+02	1.52E+02	0.502	
6	2.80E-04	1.52E+02	1.53E+02	-0.575	
7	3.55E-04	1.60E+02	1.60E+02	0.053	
8	4.43E-04	1.72E+02	1.72E+02	0.059	
9	5.64E-04	1.94E+02	1.93E+02	0.371	
10	7.13E-04	2.27E+02	2.21E+02	2.555	
11	8.81E-04	2.53E+02	2.51E+02	0.785	
12	8.90E-04	2.46E+02	2.53E+02	-2.737	
13	1.10E-03	2.75E+02	2.80E+02	-1.754	
14	1.40E-03	2.93E+02	2.90E+02	1.195	
15	1.77E-03	2.69E+02	2.66E+02	1.235	
16	2.20E-03	2.24E+02	2.25E+02	-0.370	
17	2.80E-03	1.77E+02	1.77E+02	0.029	
18	3.55E-03	1.35E+02	1.37E+02	-1.463	
19	4.43E-03	1.08E+02	1.08E+02	-0.082	
20	5.64E-03	8.38E+01	8.31E+01	0.789	

R: 152. X: 0. Y: 153. DL: 305. REQ: 170. CF: 1.0000
CLHZ ARRAY, 20 DATA POINTS, RAMP: 160.0 MICROSEC, DATA: LC19
0311 LC 1900NZ OPR XTL L 6 12+100
Ch.21 = 0.16 Ch.22 = 0.89 Ch.23 = 15 Ch.24 = 93
RMS LOG ERROR: 8.13E-03, ANTILOG YIELDS 1.8887 %
LATE TIME PARAMETERS

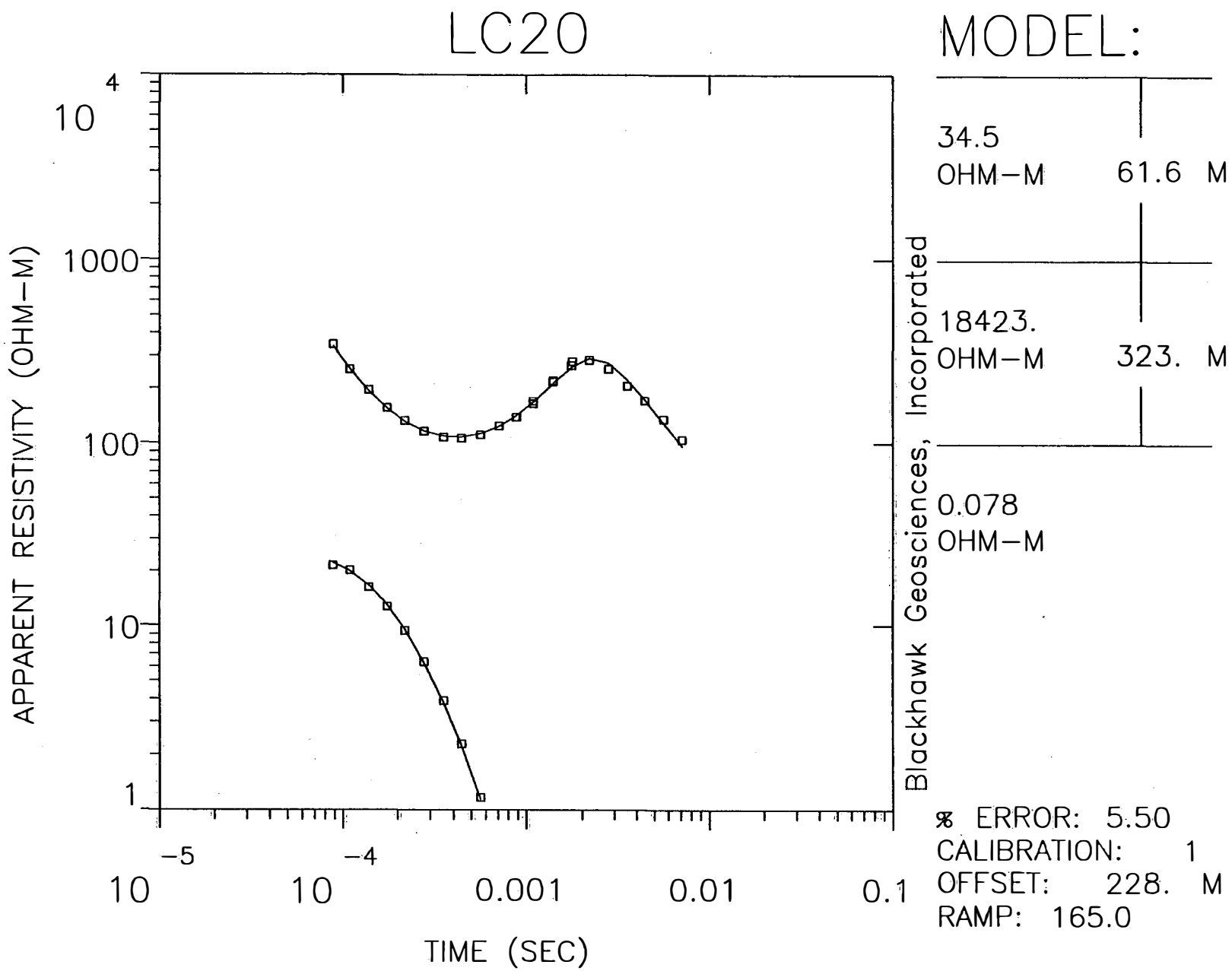
* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2
P 1	1.00				
P 2	-0.02	0.14			
P 3	0.01	-0.03	0.93		
T 1	0.00	-0.06	0.01	0.99	
T 2	0.00	0.01	-0.01	0.00	1.00

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

LAYER		MINIMUM	BEST	MAXIMUM
RHO	1	48.114	50.350	53.214
	2	1331.274	2234.357	4892.918
	3	1.200	1.577	2.048
THICK	1	53.553	57.936	63.760
	2	363.195	376.509	389.721
DEPTH	1	53.553	57.936	63.760
	2	425.616	434.444	443.662



MODEL:

34.5 OHM-M

61.6 M

18423. OHM-M

323. M

0.078 OHM-M

% ERROR: 5.50
CALIBRATION: 1
OFFSET: 228. M
RAMP: 165.0

LC20

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		467.0	1532.0		
34.49	61.6	405.3	1329.8	1.8	1.8
18423.12	322.6	82.7	271.3	0.0	1.8
0.08					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	3.46E+02	3.39E+02	2.103	
2	1.10E-04	2.54E+02	2.55E+02	-0.648	
3	1.40E-04	1.95E+02	1.93E+02	1.332	
4	1.77E-04	1.56E+02	1.54E+02	1.287	
5	2.20E-04	1.33E+02	1.31E+02	1.245	
6	2.80E-04	1.16E+02	1.16E+02	-0.589	
7	3.55E-04	1.08E+02	1.09E+02	-1.301	
8	4.43E-04	1.06E+02	1.08E+02	-1.750	
9	5.64E-04	1.11E+02	1.13E+02	-1.315	
10	7.13E-04	1.24E+02	1.24E+02	-0.066	
11	8.81E-04	1.38E+02	1.41E+02	-2.064	
12	8.90E-04	1.39E+02	1.42E+02	-2.437	
13	1.10E-03	1.69E+02	1.68E+02	0.860	
14	1.10E-03	1.64E+02	1.68E+02	-2.500	
15	1.40E-03	2.17E+02	2.11E+02	2.639	
16	1.41E-03	2.20E+02	2.13E+02	3.232	
17	1.77E-03	2.65E+02	2.61E+02	1.780	
18	1.80E-03	2.79E+02	2.64E+02	5.998	
19	2.20E-03	2.83E+02	2.90E+02	-2.285	
20	2.80E-03	2.55E+02	2.74E+02	-7.057	
21	3.55E-03	2.06E+02	2.23E+02	-7.754	
22	4.43E-03	1.71E+02	1.73E+02	-1.184	
23	5.64E-03	1.35E+02	1.29E+02	4.979	
24	7.13E-03	1.05E+02	9.63E+01	8.622	

R: 228. X: 0. Y: 229. DL: 457. REQ: 254. CF: 1.0000
CLHZ ARRAY, 24 DATA POINTS, RAMP: 165.0 MICROSEC, DATA: LC20
0311 LC 2000NZ OPR XTL L 6 12+100
Ch.21 = 0.165 Ch.22 = 0.89 Ch.23 = 11 Ch.24 = 2
RMS LOG ERROR: 2.32E-02, ANTILOG YIELDS 5.4984 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

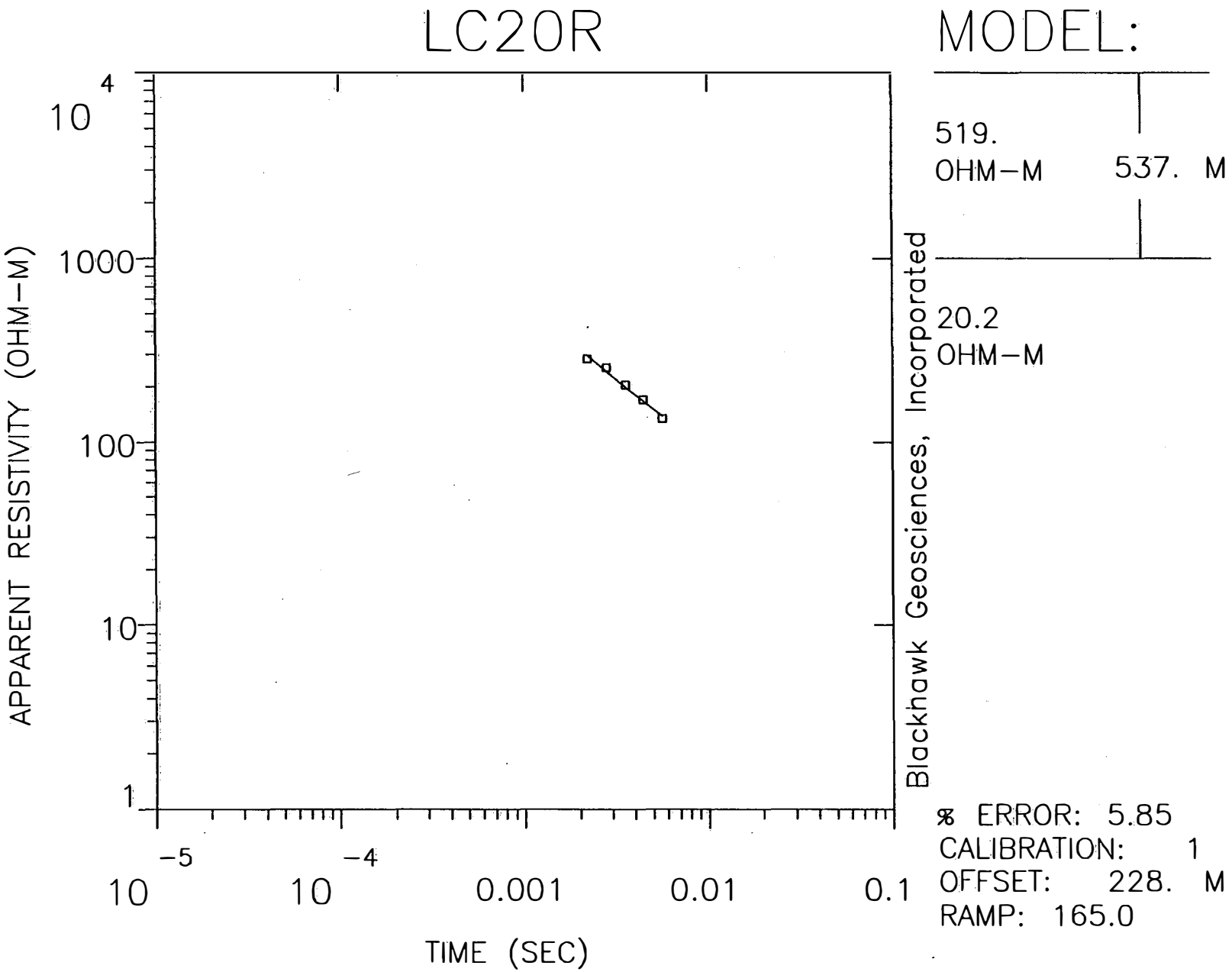
PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.65			
P 2	0.00	0.00		
P 3	-0.01	0.00	0.03	
T 1	-0.39	0.00	0.03	0.50

T 2 0.04 0.00 -0.14 0.07 0.85
P 1 P 2 P 3 T 1 T 2

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	28.233	34.490	39.808
	2	1842.312	18423.115	184231.156
	3	0.038	0.078	0.206
THICK	1	49.352	61.629	74.006
	2	290.146	322.620	371.141
DEPTH	1	49.352	61.629	74.006
	2	353.400	384.249	430.688


LC20R
MODEL:
519.
OHM-M
537. M
20.2
OHM-M
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
Blackhawk Geosciences, Incorporated
% ERROR: 5.85
CALIBRATION: 1
OFFSET: 228. M
RAMP: 165.0

LC20R

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		467.0	1532.0		
518.56	536.9	-70.0	-229.6	1.0	1.0
20.21					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	2.20E-03	2.83E+02	2.98E+02	-4.955	
2	2.80E-03	2.55E+02	2.43E+02	4.819	
3	3.55E-03	2.06E+02	2.00E+02	2.894	
4	4.43E-03	1.71E+02	1.68E+02	2.004	
5	5.64E-03	1.35E+02	1.40E+02	-3.361	

R: 228. X: 0. Y: 229. DL: 457. REQ: 254. CF: 1.0000
CLHZ ARRAY, 5 DATA POINTS, RAMP: 165.0 MICROSEC, DATA: LC20R
0311 LC 2000NZ OPR XTL L 6 12+100
Ch.21 = 0.165 Ch.22 = 0.89 Ch.23 = 11 Ch.24 = 2
RMS LOG ERROR: 2.47E-02, ANTILOG YIELDS 5.8468 %
LATE TIME PARAMETERS

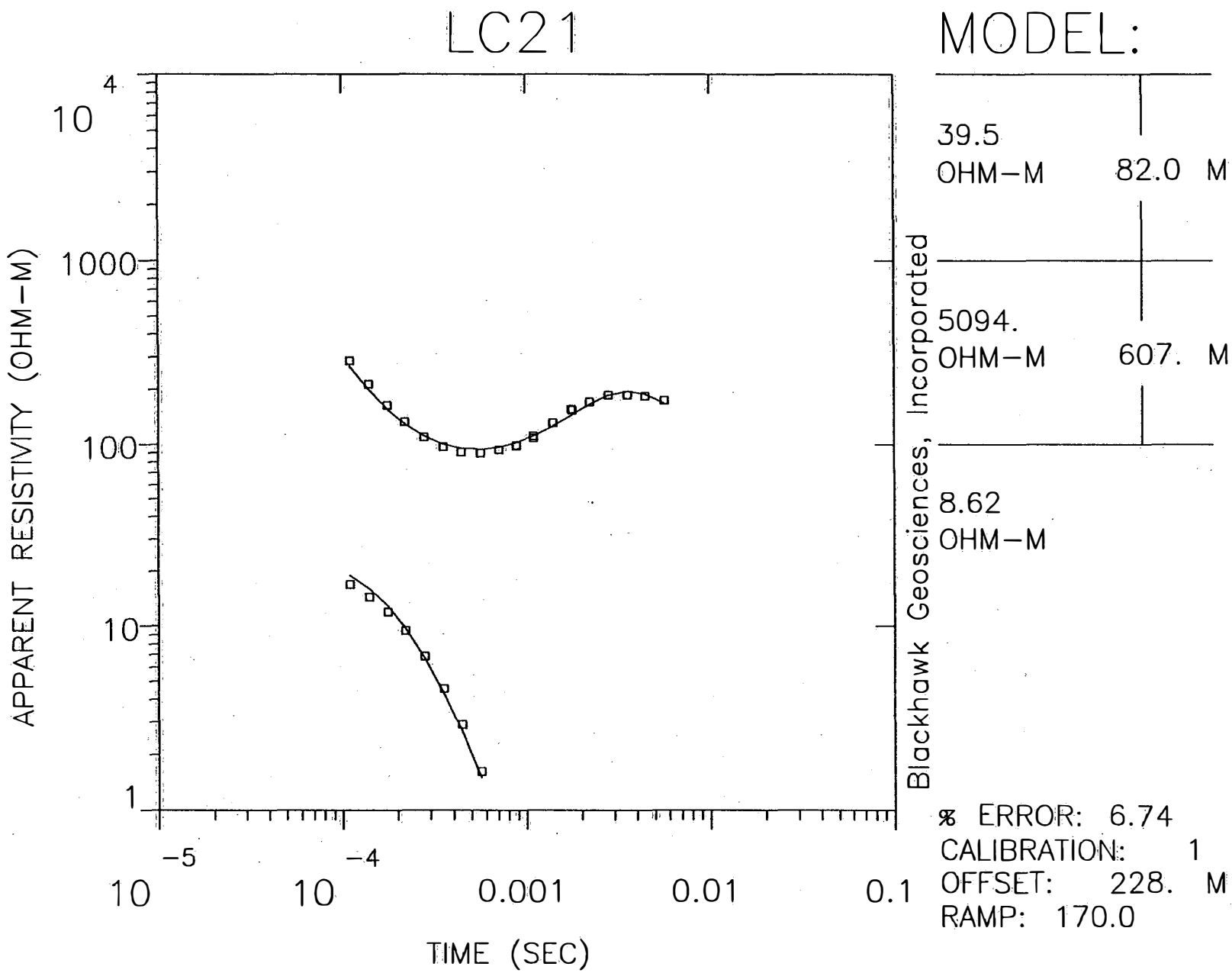
* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.05		
P 2	-0.16	0.79	
T 1	0.07	0.02	0.99
	P 1	P 2	T 1

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	201.728	518.560	1639.829
	2	6.030	20.209	30.156
THICK	1	483.678	536.941	619.103
DEPTH	1	483.678	536.941	619.103


LC21
MODEL:
39.5
OHM-M
82.0 M
5094.
OHM-M
607. M
8.62
OHM-M
% ERROR: 6.74
CALIBRATION: 1
OFFSET: 228. M
RAMP: 170.0
Blackhawk Geosciences, Incorporated
APPARENT RESISTIVITY (OHM-M)
TIME (SEC)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1

LC21

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	(FEET)	CONDUCTANCE (S) LAYER	TOTAL
		474.9	1558.0		
39.52	82.0	392.9	1288.9	2.1	2.1
5093.81	607.1	-214.2	-702.8	0.1	2.2
8.62					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	1.10E-04	2.87E+02	2.66E+02	7.698	
2	1.40E-04	2.13E+02	1.98E+02	7.538	
3	1.77E-04	1.63E+02	1.56E+02	4.771	
4	2.20E-04	1.33E+02	1.30E+02	2.358	
5	2.80E-04	1.10E+02	1.11E+02	-1.308	
6	3.55E-04	9.69E+01	1.01E+02	-3.706	
7	4.43E-04	9.07E+01	9.55E+01	-4.977	
8	5.64E-04	8.96E+01	9.42E+01	-4.829	
9	7.13E-04	9.33E+01	9.67E+01	-3.478	
10	8.81E-04	9.80E+01	1.02E+02	-4.129	
11	8.90E-04	9.85E+01	1.03E+02	-3.891	
12	1.10E-03	1.11E+02	1.11E+02	-0.385	
13	1.10E-03	1.09E+02	1.11E+02	-2.587	
14	1.40E-03	1.31E+02	1.26E+02	3.931	
15	1.41E-03	1.31E+02	1.26E+02	3.852	
16	1.77E-03	1.55E+02	1.45E+02	7.562	
17	1.80E-03	1.54E+02	1.46E+02	5.364	
18	2.22E-03	1.70E+02	1.66E+02	2.837	
19	2.80E-03	1.86E+02	1.85E+02	0.250	
20	3.55E-03	1.86E+02	1.95E+02	-4.698	
21	4.43E-03	1.84E+02	1.88E+02	-2.332	
22	5.64E-03	1.74E+02	1.67E+02	3.922	

R: 228. X: 0. Y: 229. DL: 457. REQ: 254. CF: 1.0000
CLHZ ARRAY, 22 DATA POINTS, RAMP: 170.0 MICROSEC, DATA: LC21
0311 LC 2100NZ OPR XTL L 6 12+100
Ch.21 = 0.17 Ch.22 = 0.89 Ch.23 = 11 Ch.24 = 20
RMS LOG ERROR: 2.83E-02, ANTILOG YIELDS 6.7367 %
LATE TIME PARAMETERS

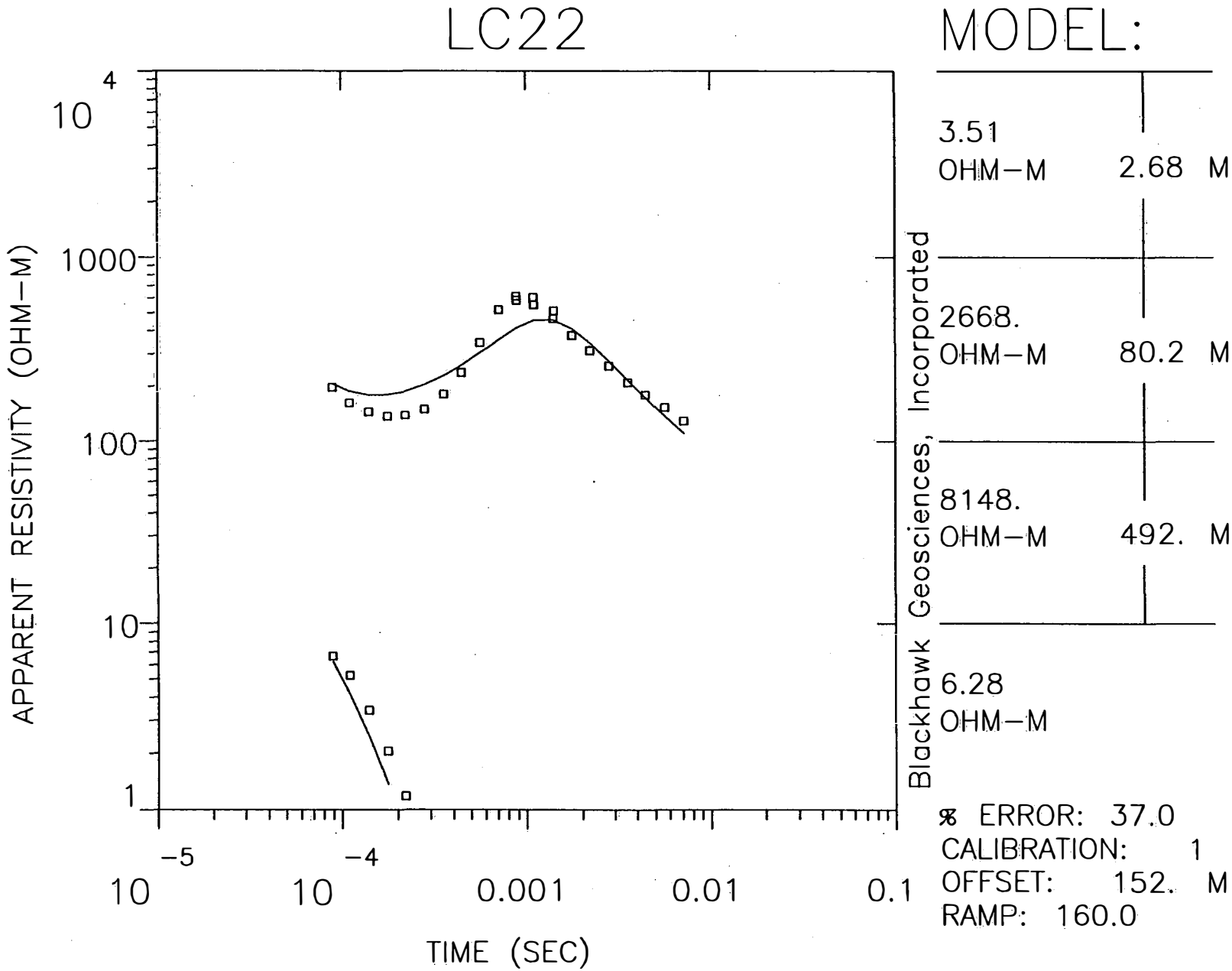
* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.98				
P 2	-0.01	0.00			
P 3	0.03	-0.02	0.11		
T 1	-0.03	-0.02	0.05	0.96	
T 2	0.00	0.01	-0.04	0.00	0.99
	P 1	P 2	P 3	T 1	T 2

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	32.534	39.523	45.752
	2	1364.909	5093.808	50938.078
	3	2.386	8.624	31.170
THICK	1	63.900	82.011	98.945
	2	554.183	607.077	663.827
DEPTH	1	63.900	82.011	98.945
	2	635.824	689.089	746.203


LC22
MODEL:
APPARENT RESISTIVITY (OHM-M)
10 4
1000
100
10
1
10 -5
10 -4
0.001
0.01
0.1
TIME (SEC)
3.51
OHM-M
2.68 M
2668.
OHM-M
80.2 M
8148.
OHM-M
492. M
6.28
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 37.0
CALIBRATION: 1
OFFSET: 152. M
RAMP: 160.0

LC22

MODEL: 4 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	(FEET)	CONDUCTANCE (S) LAYER	TOTAL
		399.9	1312.0		
3.51	2.7	397.2	1303.2	0.8	0.8
2668.45	80.2	317.0	1040.1	0.0	0.8
8148.21	492.0	-175.0	-574.0	0.1	0.9
6.28					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	1.97E+02	2.06E+02	-4.432	
2	1.10E-04	1.62E+02	1.88E+02	-13.923	
3	1.40E-04	1.44E+02	1.79E+02	-19.438	
4	1.77E-04	1.37E+02	1.80E+02	-23.951	
5	2.20E-04	1.38E+02	1.87E+02	-26.176	
6	2.80E-04	1.49E+02	2.03E+02	-26.628	
7	3.55E-04	1.81E+02	2.27E+02	-20.370	
8	4.43E-04	2.36E+02	2.59E+02	-8.839	
9	5.64E-04	3.43E+02	3.04E+02	12.688	
10	7.13E-04	5.19E+02	3.59E+02	44.515	
11	8.81E-04	6.11E+02	4.12E+02	48.349	
12	8.90E-04	5.83E+02	4.14E+02	40.868	
13	1.10E-03	6.06E+02	4.54E+02	33.396	
14	1.10E-03	5.53E+02	4.55E+02	21.578	
15	1.40E-03	4.64E+02	4.57E+02	1.540	
16	1.41E-03	5.12E+02	4.56E+02	12.297	
17	1.77E-03	3.78E+02	4.09E+02	-7.742	
18	2.20E-03	3.11E+02	3.45E+02	-9.747	
19	2.80E-03	2.58E+02	2.74E+02	-5.877	
20	3.55E-03	2.09E+02	2.16E+02	-3.554	
21	4.43E-03	1.80E+02	1.73E+02	3.636	
22	5.64E-03	1.53E+02	1.37E+02	11.323	
23	7.13E-03	1.28E+02	1.10E+02	16.969	

R: 152. X: 0. Y: 153. DL: 305. REQ: 170. CF: 1.0000
CLHZ ARRAY, 23 DATA POINTS, RAMP: 160.0 MICROSEC, DATA: LC22
0411 LC 2200NZ OPR XTL L 6 12+100 1
Ch.21 = 0.16 Ch.22 = 0.89 Ch.23 = 15 Ch.24 = 93
RMS LOG ERROR: 1.37E-01, ANTILOG YIELDS 36.9702 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.69			
P 2	-0.01	0.01		
P 3	-0.02	0.01	0.01	
P 4	0.14	-0.02	-0.02	0.26

```
T 1 -0.32 -0.05 -0.03  0.15  0.68
T 2  0.00 -0.01  0.00 -0.01  0.02  0.04
T 3 -0.01  0.00  0.00 -0.02 -0.01  0.18  0.96
       P 1   P 2   P 3   P 4   T 1   T 2   T 3
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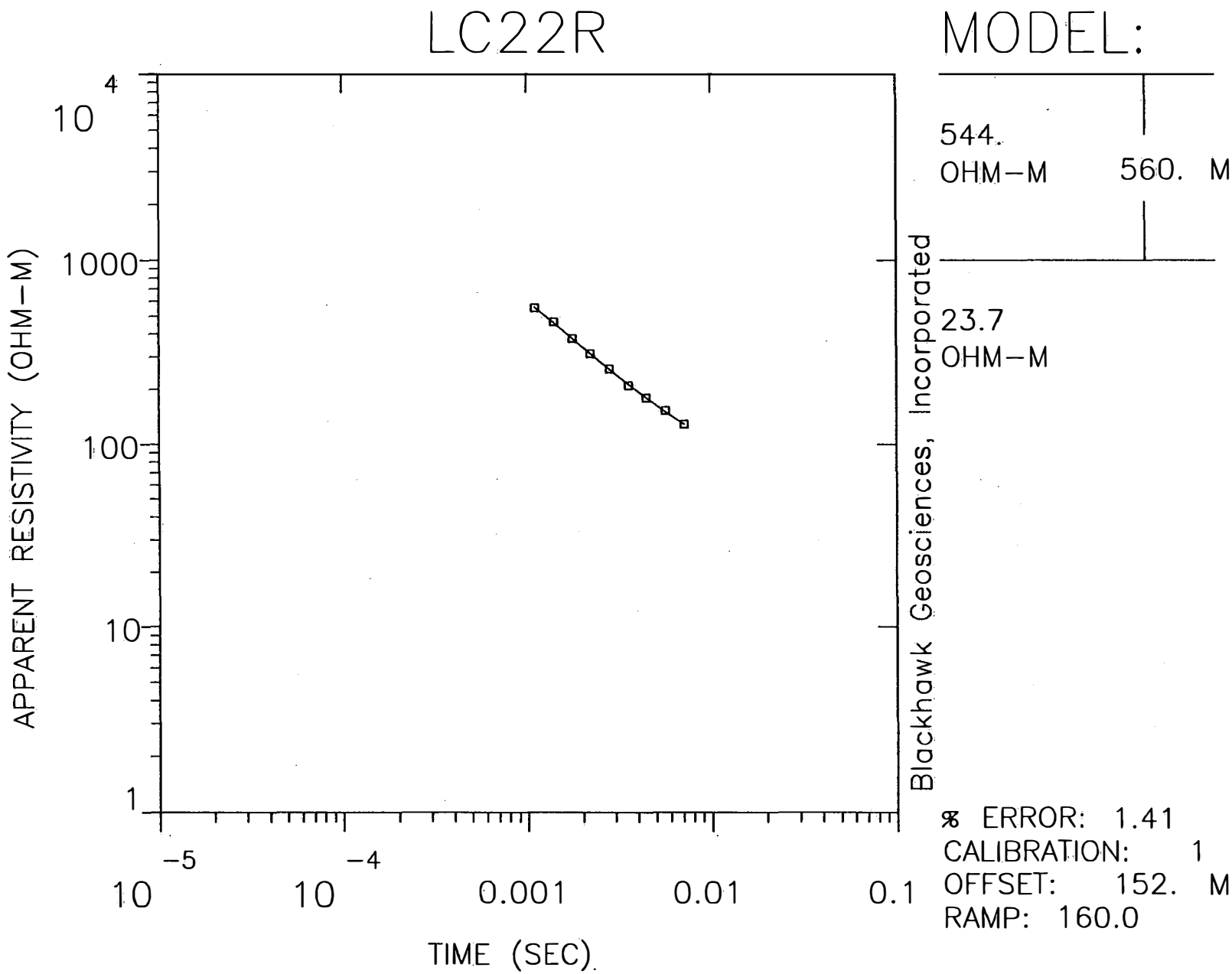

LC22R
MODEL:
544.
OHM-M
560. M
23.7
OHM-M
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
Blackhawk Geosciences, Incorporated
% ERROR: 1.41
CALIBRATION: 1
OFFSET: 152. M
RAMP: 160.0

LC22R

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		399.9	1312.0		
543.85	559.7	-159.8	-524.1	1.0	1.0
23.67					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	1.10E-03	5.53E+02	5.56E+02	-0.657	
2	1.40E-03	4.64E+02	4.58E+02	1.256	
3	1.77E-03	3.78E+02	3.76E+02	0.403	
4	2.20E-03	3.11E+02	3.13E+02	-0.714	
5	2.80E-03	2.58E+02	2.57E+02	0.489	
6	3.55E-03	2.09E+02	2.13E+02	-1.866	
7	4.43E-03	1.80E+02	1.80E+02	0.021	
8	5.64E-03	1.53E+02	1.51E+02	1.168	
9	7.13E-03	1.28E+02	1.29E+02	-0.130	

R: 152. X: 0. Y: 153. DL: 305. REQ: 170. CF: 1.0000
CLHZ ARRAY, 9 DATA POINTS, RAMP: 160.0 MICROSEC, DATA: LC22R
0411 LC 2200NZ OPR XTL L 6 12+100 1
Ch.21 = 0.16 Ch.22 = 0.89 Ch.23 = 15 Ch.24 = 93
RMS LOG ERROR: 6.07E-03, ANTILOG YIELDS 1.4080 %
LATE TIME PARAMETERS

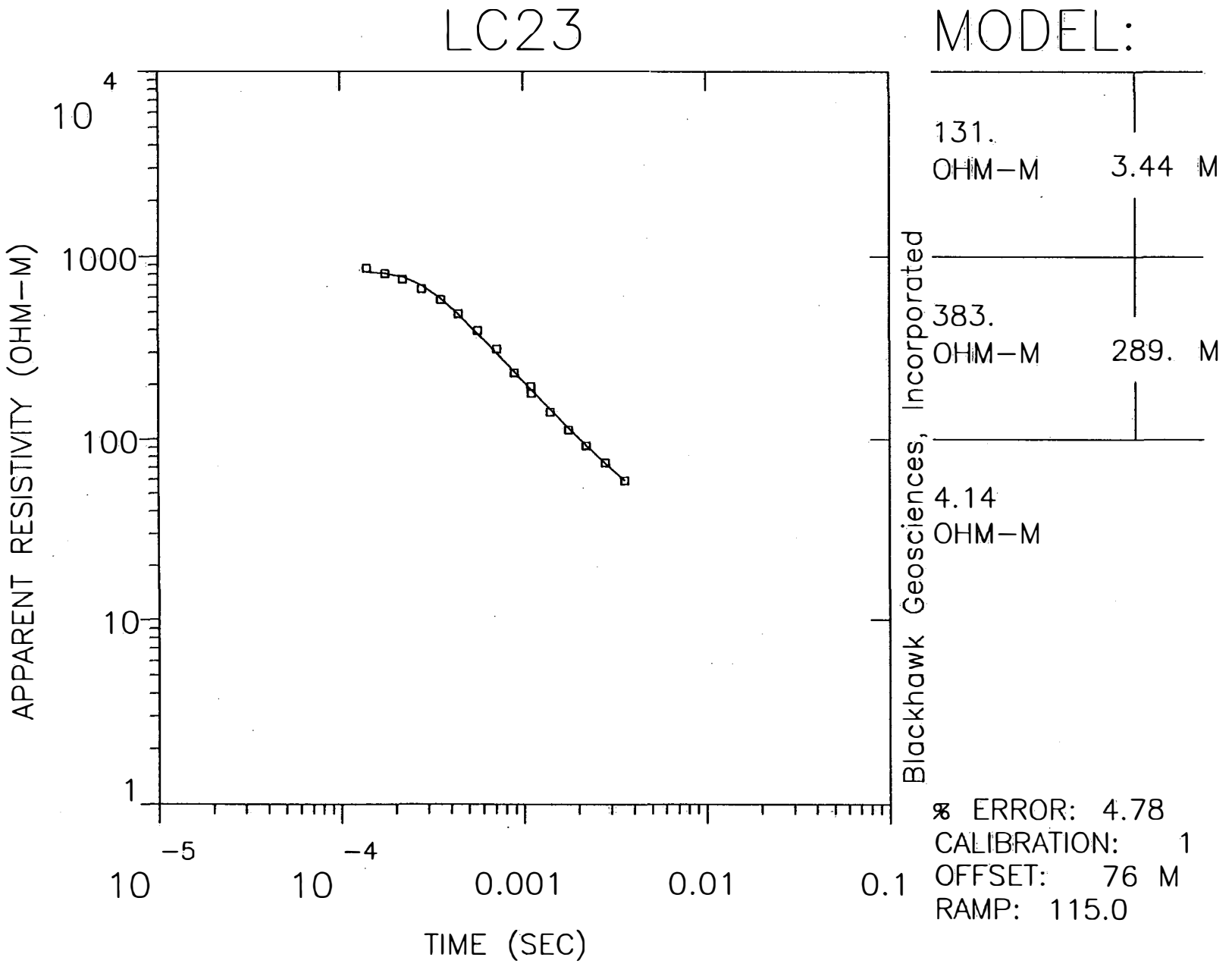
* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	T 1
P 1	0.74		
P 2	-0.15	0.85	
T 1	0.04	0.02	0.99

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	494.697	543.854	629.221
	2	21.741	23.668	25.890
THICK	1	548.027	559.654	568.209
DEPTH	1	548.027	559.654	568.209


LC23
MODEL:
131.
OHM-M
3.44 M
383.
OHM-M
289. M
4.14
OHM-M
% ERROR: 4.78
CALIBRATION: 1
OFFSET: 76 M
RAMP: 115.0
Blackhawk Geosciences, Incorporated
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)

LC23

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		239.9	787.0		
130.70	3.4	236.4	775.7	0.0	0.0
382.70	288.7	-52.3	-171.6	0.8	0.8
4.14					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	1.40E-04	8.63E+02	8.25E+02	4.533	
2	1.77E-04	8.08E+02	8.09E+02	-0.125	
3	2.20E-04	7.52E+02	7.74E+02	-2.910	
4	2.80E-04	6.67E+02	6.98E+02	-4.412	
5	3.55E-04	5.83E+02	5.92E+02	-1.435	
6	4.43E-04	4.89E+02	4.85E+02	0.840	
7	5.64E-04	3.95E+02	3.80E+02	4.022	
8	7.13E-04	3.14E+02	2.97E+02	6.025	
9	8.90E-04	2.33E+02	2.34E+02	-0.707	
10	1.10E-03	1.96E+02	1.88E+02	4.215	
11	1.10E-03	1.79E+02	1.87E+02	-4.248	
12	1.40E-03	1.41E+02	1.46E+02	-3.220	
13	1.77E-03	1.12E+02	1.15E+02	-2.163	
14	2.20E-03	9.17E+01	9.28E+01	-1.218	
15	2.80E-03	7.42E+01	7.37E+01	0.719	
16	3.55E-03	5.91E+01	5.93E+01	-0.290	

R: 76. X: 0. Y: 76. DL: 152. REQ: 84. CF: 1.0000
CLHZ ARRAY, 16 DATA POINTS, RAMP: 115.0 MICROSEC, DATA: LC23
0411 LC 2300NZ OPR XTL L 6 12+100
Ch.21 = 0.115 Ch.22 = 0.89 Ch.23 = 19 Ch.24 = 2
RMS LOG ERROR: 2.03E-02, ANTILOG YIELDS 4.7842 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

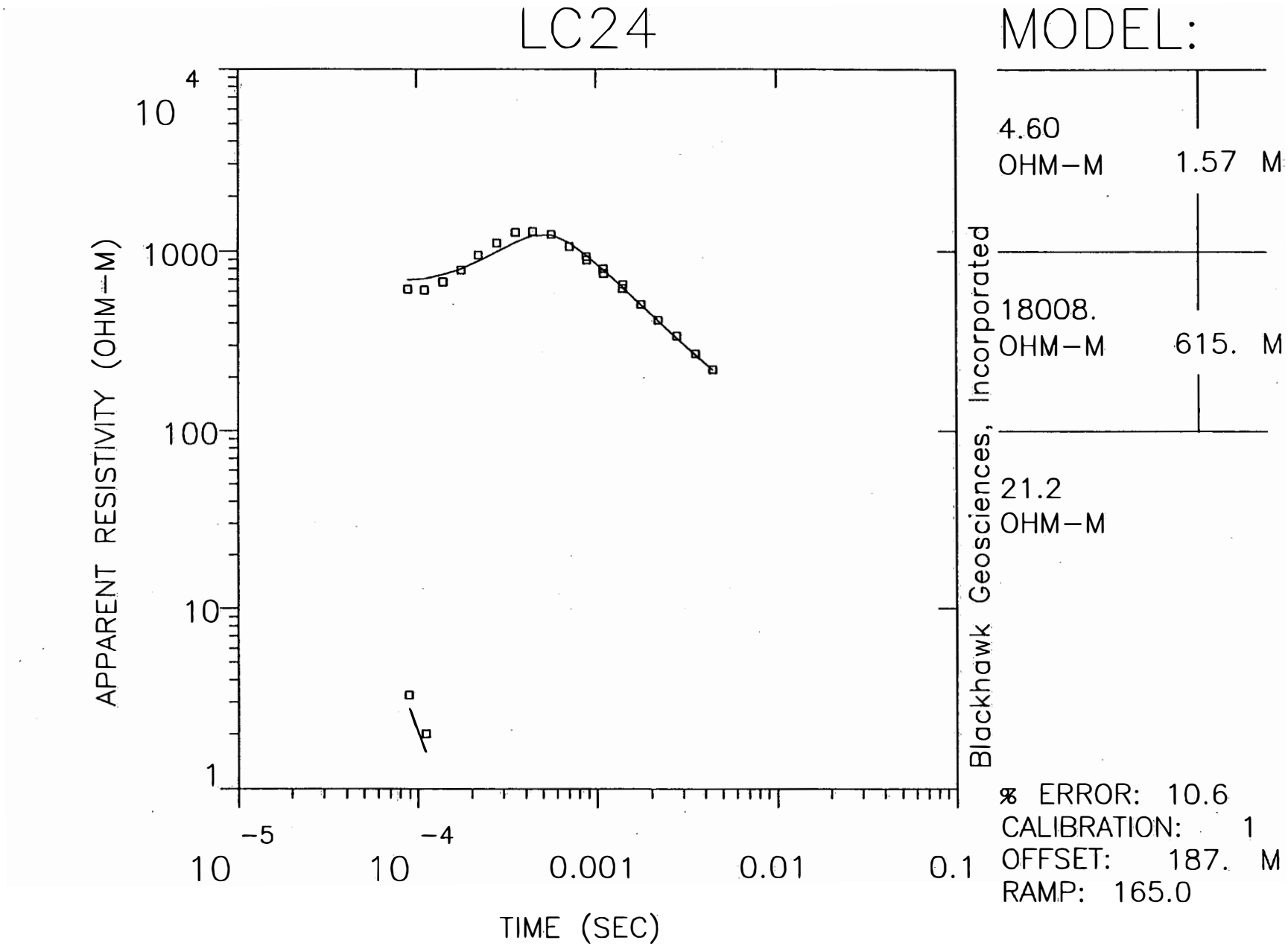
PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.01				
P 2	0.07	0.99			
P 3	0.00	-0.03	0.81		
T 1	0.00	-0.05	-0.01	0.01	
T 2	0.00	0.00	-0.01	0.01	1.00
	P 1	P 2	P 3	T 1	T 2

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	57.432	130.704	456.714

	2	352.307	382.697	435.150
	3	2.984	4.139	5.365
THICK	1	0.934	3.441	8.905
	2	282.374	288.732	294.092
DEPTH	1	0.934	3.441	8.905
	2	287.062	292.173	296.758


LC24
MODEL:
4.60
OHM-M
1.57 M
18008.
OHM-M
615. M
21.2
OHM-M
% ERROR: 10.6
CALIBRATION: 1
OFFSET: 187. M
RAMP: 165.0
Blackhawk Geosciences, Incorporated
APPARENT RESISTIVITY (OHM-M)
TIME (SEC)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1

LC24

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		590.1	1936.0		
4.60	1.6	588.5	1930.8	0.3	0.3
18007.91	615.1	-26.6	-87.3	0.0	0.4
21.23					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	6.18E+02	6.95E+02	-11.188	
2	1.10E-04	6.05E+02	7.05E+02	-14.202	
3	1.40E-04	6.77E+02	7.42E+02	-8.699	
4	1.77E-04	7.90E+02	8.03E+02	-1.530	
5	2.20E-04	9.52E+02	8.82E+02	7.990	
6	2.80E-04	1.11E+03	9.94E+02	11.772	
7	3.55E-04	1.28E+03	1.12E+03	13.853	
8	4.43E-04	1.29E+03	1.22E+03	5.365	
9	5.64E-04	1.24E+03	1.23E+03	0.888	
10	7.13E-04	1.07E+03	1.11E+03	-4.205	
11	8.81E-04	9.38E+02	9.52E+02	-1.563	
12	8.90E-04	8.96E+02	9.45E+02	-5.190	
13	1.10E-03	8.04E+02	7.91E+02	1.628	
14	1.10E-03	7.56E+02	7.88E+02	-4.098	
15	1.40E-03	6.24E+02	6.32E+02	-1.179	
16	1.41E-03	6.57E+02	6.27E+02	4.794	
17	1.77E-03	5.10E+02	5.05E+02	0.944	
18	2.20E-03	4.16E+02	4.11E+02	1.201	
19	2.80E-03	3.39E+02	3.30E+02	2.748	
20	3.55E-03	2.71E+02	2.67E+02	1.335	
21	4.43E-03	2.21E+02	2.21E+02	0.087	

R: 187. X: 0. Y: 187. DL: 373. REQ: 208. CF: 1.0000
CLHZ ARRAY, 21 DATA POINTS, RAMP: 165.0 MICROSEC, DATA: LC24
0511 LC 2400NZ OPR XTL L 6 12+100
Ch.21 = 0.165 Ch.22 = 0.89 Ch.23 = 12.5 Ch.24 =
RMS LOG ERROR: 4.37E-02, ANTILOG YIELDS 10.5812 %
LATE TIME PARAMETERS

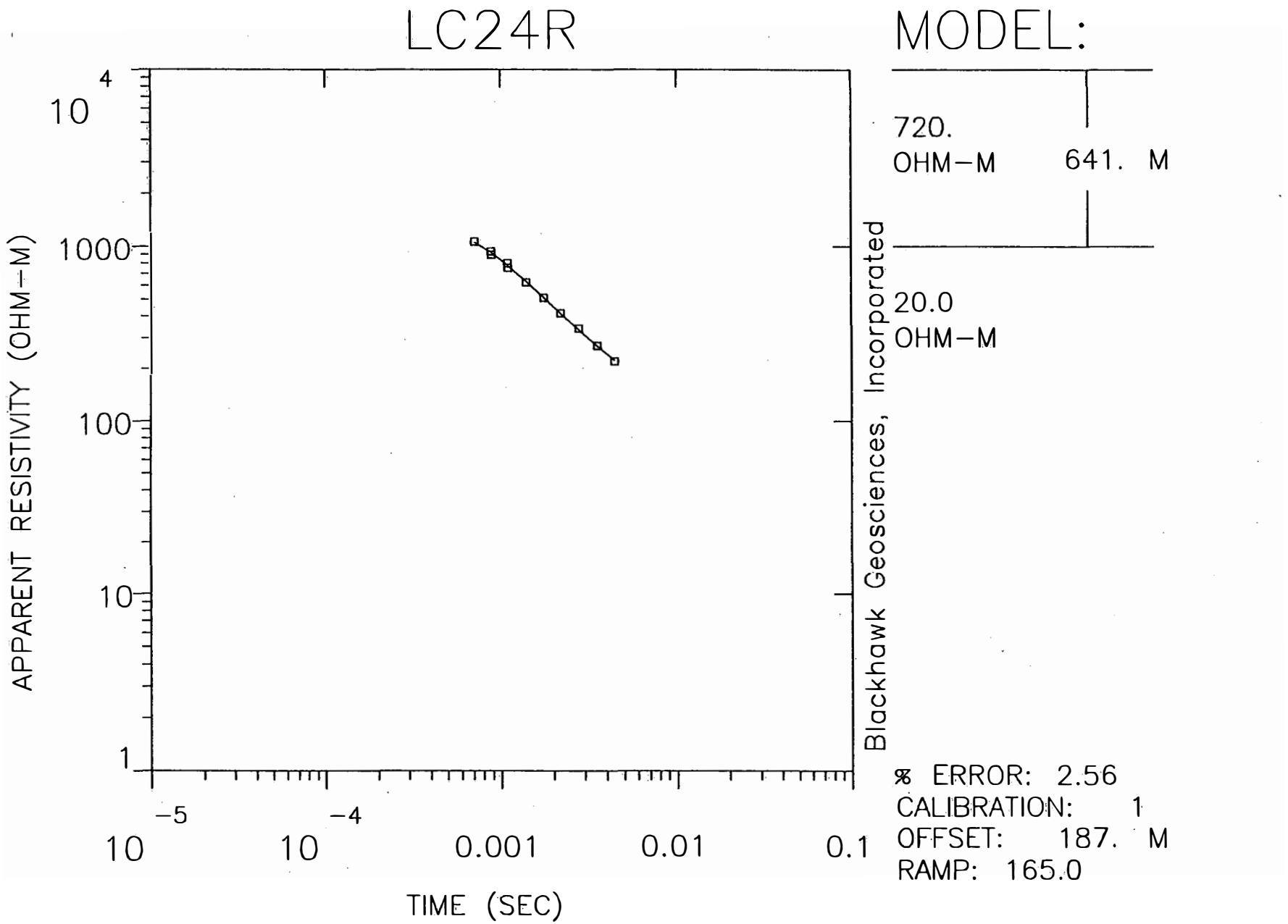
* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.18				
P 2	0.00	0.00			
P 3	0.00	0.00	0.00		
T 1	-0.18	0.00	0.01	0.18	
T 2	0.02	0.00	0.00	-0.03	0.29
	P 1	P 2	P 3	T 1	T 2

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	4.381	4.599	4.824
	2	10126.591	18007.908	180079.078
	3	11.938	21.229	36.463
THICK	1	1.497	1.574	1.650
	2	596.213	615.126	634.553
DEPTH	1	1.497	1.574	1.650
	2	597.785	616.699	636.128


LC24R
MODEL:
720.
OHM-M
641. M
20.0
OHM-M
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
Blackhawk Geosciences, Incorporated
% ERROR: 2.56
CALIBRATION: 1
OFFSET: 187. M
RAMP: 165.0

LC24R

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		590.1	1936.0		
720.03	640.5	-50.5	-165.5	0.9	0.9
19.97					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	7.13E-04	1.07E+03	1.06E+03	0.875	
2	8.81E-04	9.38E+02	9.26E+02	1.253	
3	8.90E-04	8.96E+02	9.19E+02	-2.572	
4	1.10E-03	8.04E+02	7.81E+02	2.979	
5	1.10E-03	7.56E+02	7.78E+02	-2.839	
6	1.40E-03	6.24E+02	6.29E+02	-0.777	
7	1.77E-03	5.10E+02	5.07E+02	0.546	
8	2.20E-03	4.16E+02	4.15E+02	0.306	
9	2.80E-03	3.39E+02	3.33E+02	1.612	
10	3.55E-03	2.71E+02	2.70E+02	0.061	
11	4.43E-03	2.21E+02	2.24E+02	-1.313	

R: 187. X: 0. Y: 187. DL: 373. REQ: 208. CF: 1.0000
CLHZ ARRAY, 11 DATA POINTS, RAMP: 165.0 MICROSEC, DATA: LC24R
0511 LC 2400NZ OPR XTL L 6 12+100
Ch.21 = 0.165 Ch.22 = 0.89 Ch.23 = 12.5 Ch.24 =
RMS LOG ERROR: 1.10E-02, ANTILOG YIELDS 2.5633 %
LATE TIME PARAMETERS

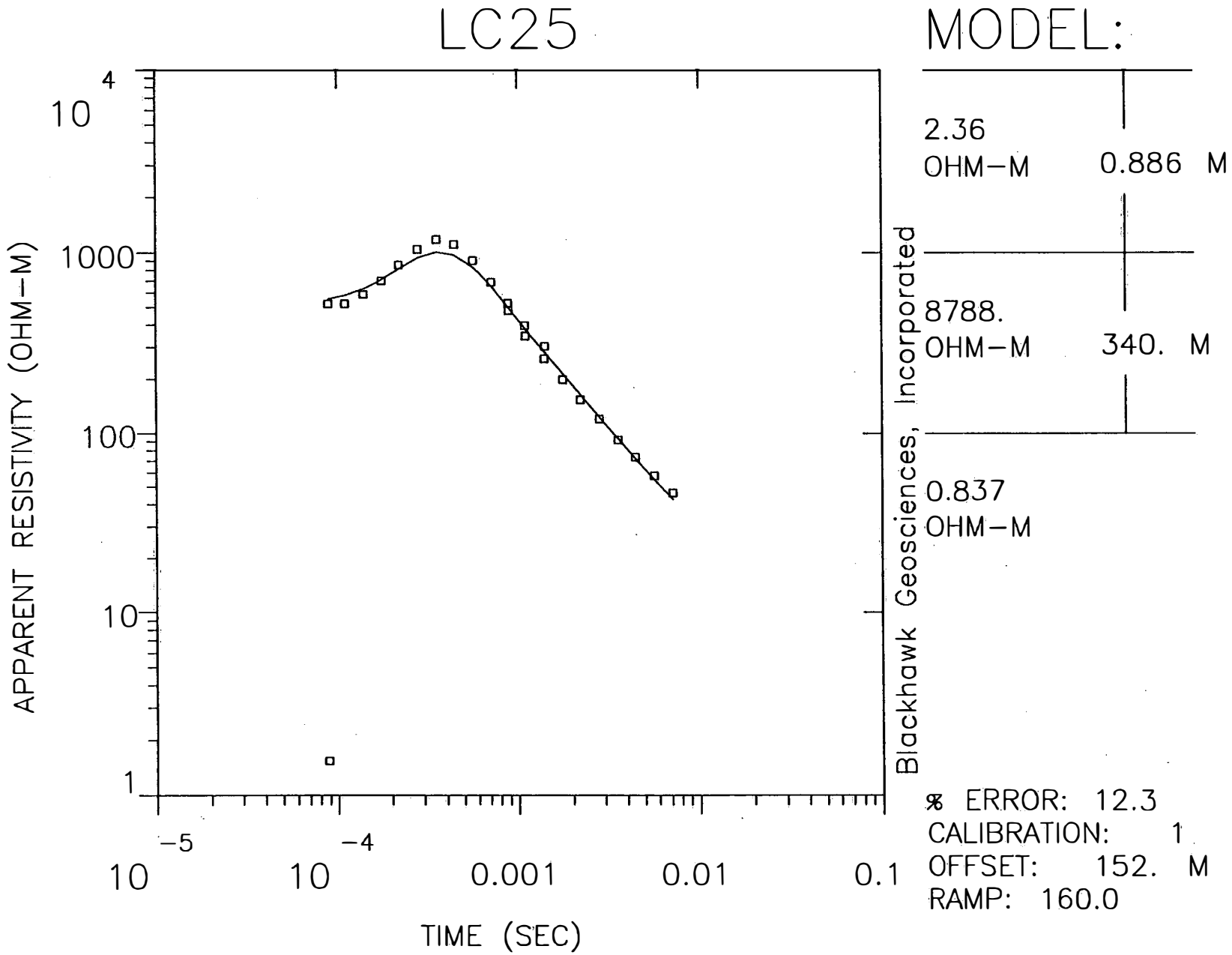
* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	1.00		
P 2	0.00	0.99	
T 1	0.00	0.00	1.00
	P 1	P 2	T 1

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	668.954	720.027	792.853
	2	16.068	19.969	24.891
THICK	1	633.425	640.543	647.469
DEPTH	1	633.425	640.543	647.469


LC25
MODEL:
APPARENT RESISTIVITY (OHM-M)
10 4
1000
100
10
1
10 -5
10 -4
0.001
0.01
0.1
TIME (SEC)
2.36
OHM-M
0.886 M
8788.
OHM-M
340. M
0.837
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 12.3
CALIBRATION: 1
OFFSET: 152. M
RAMP: 160.0

LC25

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		298.1	978.0		
2.36	0.9	297.2	975.1	0.4	0.4
8787.82	339.6	-42.4	-139.2	0.0	0.4
0.84					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	5.22E+02	5.57E+02	-6.195	
2	1.10E-04	5.22E+02	5.81E+02	-10.207	
3	1.40E-04	5.89E+02	6.34E+02	-7.230	
4	1.77E-04	7.00E+02	7.15E+02	-2.196	
5	2.20E-04	8.61E+02	8.15E+02	5.610	
6	2.80E-04	1.04E+03	9.36E+02	11.300	
7	3.55E-04	1.18E+03	1.01E+03	17.258	
8	4.43E-04	1.11E+03	9.76E+02	14.130	
9	5.64E-04	9.05E+02	8.35E+02	8.313	
10	7.13E-04	6.87E+02	6.53E+02	5.255	
11	8.81E-04	5.25E+02	5.01E+02	4.854	
12	8.90E-04	4.78E+02	4.94E+02	-3.240	
13	1.10E-03	3.97E+02	3.80E+02	4.228	
14	1.10E-03	3.46E+02	3.79E+02	-8.773	
15	1.40E-03	2.60E+02	2.83E+02	-8.113	
16	1.41E-03	3.05E+02	2.80E+02	8.732	
17	1.77E-03	1.99E+02	2.14E+02	-6.941	
18	2.20E-03	1.54E+02	1.65E+02	-6.935	
19	2.80E-03	1.21E+02	1.24E+02	-2.708	
20	3.55E-03	9.15E+01	9.39E+01	-2.534	
21	4.43E-03	7.37E+01	7.27E+01	1.402	
22	5.64E-03	5.79E+01	5.53E+01	4.721	
23	7.13E-03	4.63E+01	4.26E+01	8.714	

R: 152. X: 0. Y: 153. DL: 305. REQ: 170. CF: 1.0000
CLHZ ARRAY, 23 DATA POINTS, RAMP: 160.0 MICROSEC, DATA: LC25
0511 LC 2500NZ OPR XTL L 6 12+100
Ch.21 = 0.16 Ch.22 = 0.89 Ch.23 = 15 Ch.24 = 93
RMS LOG ERROR: 5.02E-02, ANTILOG YIELDS 12.2622 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

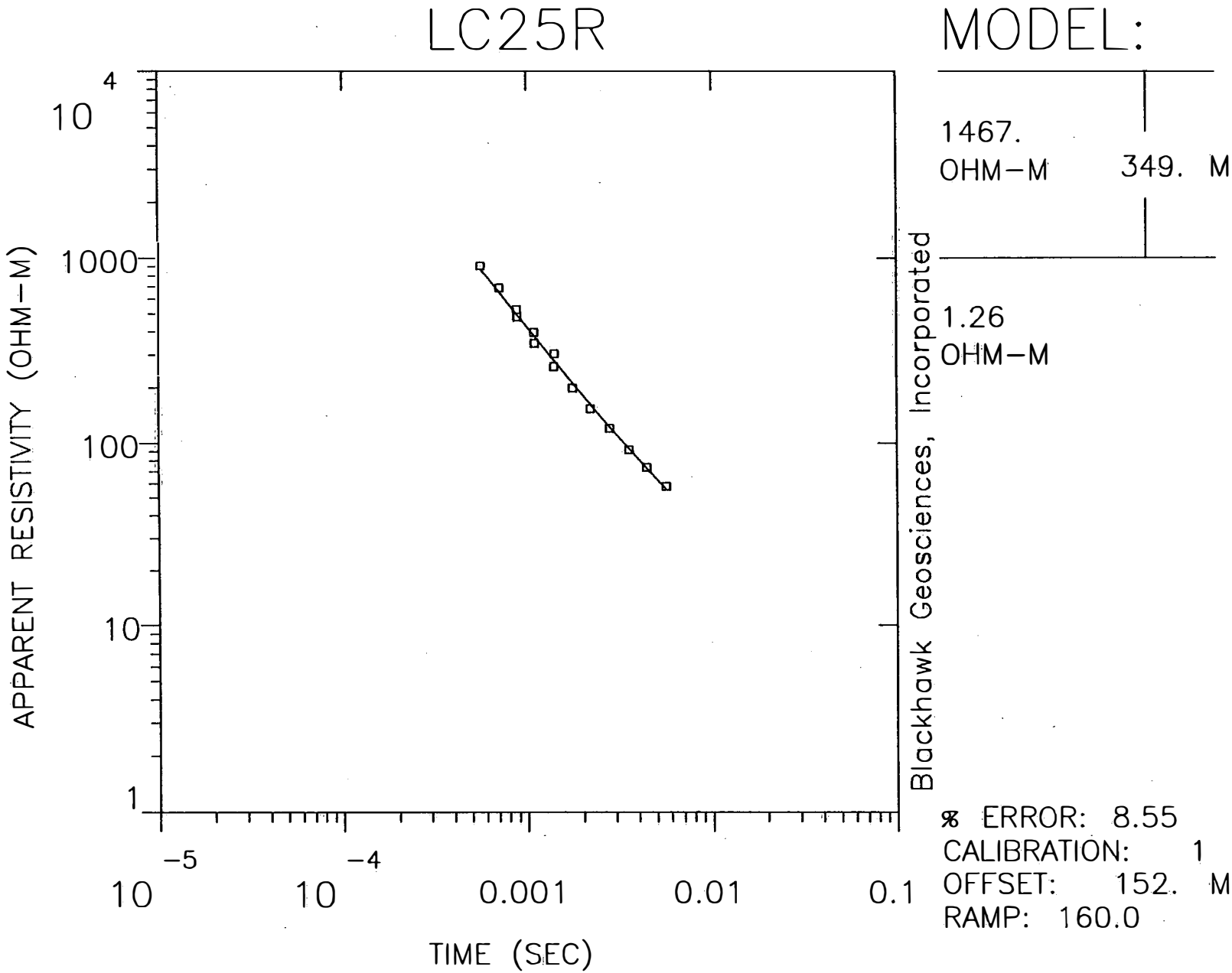
PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.78				
P 2	-0.01	0.01			
P 3	0.11	-0.02	0.42		
T 1	-0.22	-0.03	0.13	0.77	
T 2	0.01	0.00	-0.05	0.01	0.99

P 1 P 2 P 3 T 1 T 2

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	1.076	2.364	10.059
	2	2778.952	8787.817	87878.172
	3	0.062	0.837	1.742
THICK	1	0.402	0.886	3.849
	2	257.868	339.628	365.899
DEPTH	1	0.402	0.886	3.849
	2	259.326	340.515	366.674


LC25R
MODEL:
1467.
OHM-M
349. M
1.26
OHM-M
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
Blackhawk Geosciences, Incorporated
% ERROR: 8.55
CALIBRATION: 1
OFFSET: 152. M
RAMP: 160.0

LC25R

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		298.1	978.0		
1467.03	348.7	-50.6	-165.9	0.2	0.2
1.26					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	5.64E-04	9.05E+02	8.72E+02	3.829	
2	7.13E-04	6.87E+02	6.48E+02	6.047	
3	8.81E-04	5.25E+02	4.97E+02	5.706	
4	8.90E-04	4.78E+02	4.90E+02	-2.480	
5	1.10E-03	3.97E+02	3.79E+02	4.680	
6	1.10E-03	3.46E+02	3.77E+02	-8.378	
7	1.40E-03	2.60E+02	2.81E+02	-7.350	
8	1.41E-03	3.05E+02	2.78E+02	9.657	
9	1.77E-03	1.99E+02	2.11E+02	-5.766	
10	2.20E-03	1.54E+02	1.63E+02	-5.827	
11	2.80E-03	1.21E+02	1.23E+02	-1.886	
12	3.55E-03	9.15E+01	9.36E+01	-2.202	
13	4.43E-03	7.37E+01	7.29E+01	1.047	
14	5.64E-03	5.79E+01	5.59E+01	3.445	

R: 152. X: 0. Y: 153. DL: 305. REQ: 170. CF: 1.0000
CLHZ ARRAY, 14 DATA POINTS, RAMP: 160.0 MICROSEC, DATA: LC25R
0511 LC 2500NZ OPR XTL L 6 12+100
Ch.21 = 0.16 Ch.22 = 0.89 Ch.23 = 15 Ch.24 = 93
RMS LOG ERROR: 3.56E-02, ANTILOG YIELDS 8.5510 %
LATE TIME PARAMETERS

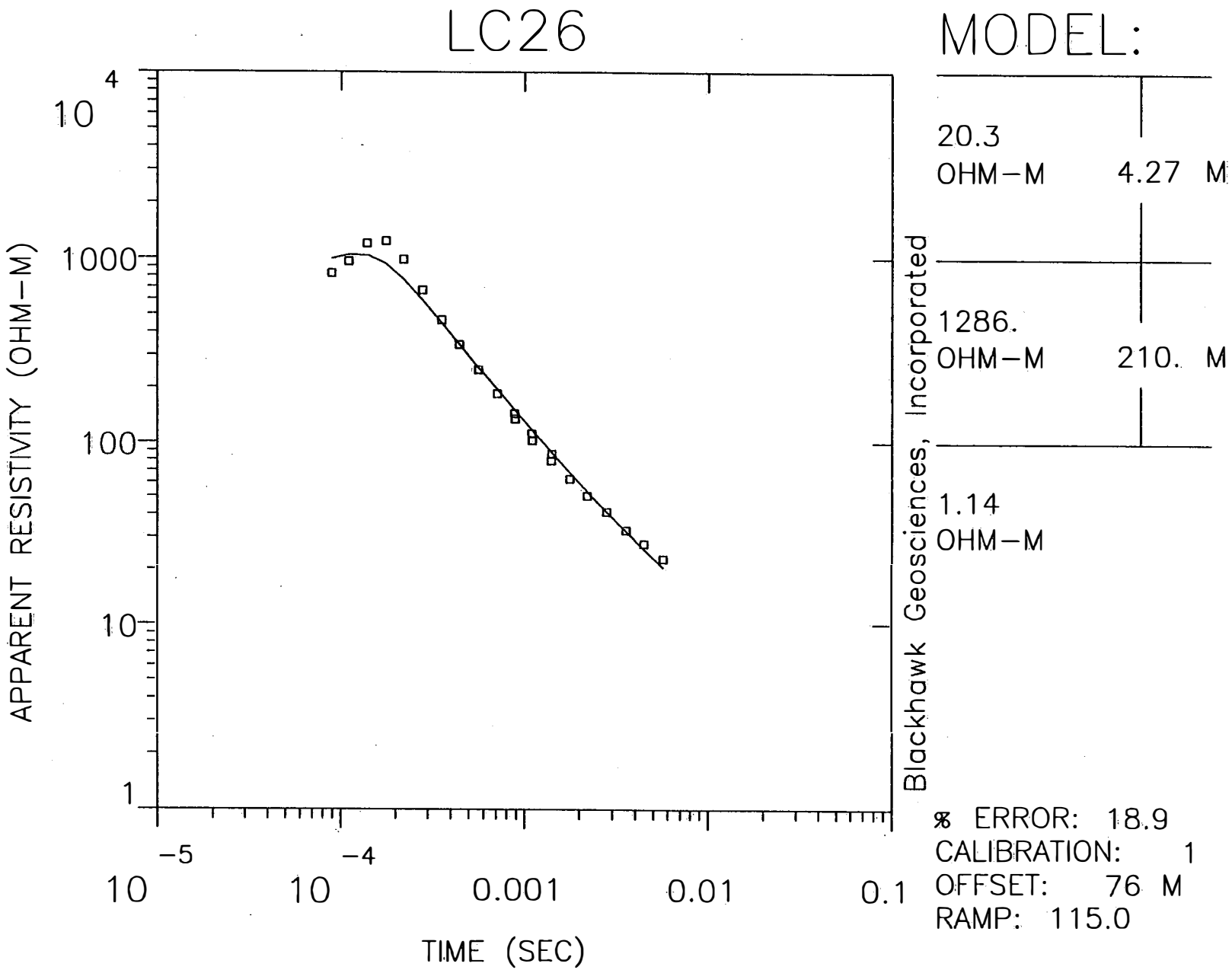
* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	T 1
P 1	0.02		
P 2	-0.07	0.50	
T 1	0.00	-0.04	1.00

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	824.971	1467.030	1584.998
	2	0.416	1.261	2.186
THICK	1	314.072	348.658	367.204
DEPTH	1	314.072	348.658	367.204


LC26
MODEL:
20.3
OHM-M
4.27 M
1286.
OHM-M
210. M
1.14
OHM-M
% ERROR: 18.9
CALIBRATION: 1
OFFSET: 76 M
RAMP: 115.0
Blackhawk Geosciences, Incorporated
APPARENT RESISTIVITY (OHM-M)
TIME (SEC)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1

LC26

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		171.9	564.0		
20.25	4.3	167.6	550.0	0.2	0.2
1286.10	209.7	-42.1	-138.2	0.2	0.4
1.14					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	8.28E+02	9.94E+02	-16.666	
2	1.10E-04	9.59E+02	1.04E+03	-7.924	
3	1.40E-04	1.21E+03	1.03E+03	16.747	
4	1.77E-04	1.23E+03	9.28E+02	32.894	
5	2.20E-04	9.85E+02	7.73E+02	27.315	
6	2.80E-04	6.70E+02	5.97E+02	12.344	
7	3.55E-04	4.64E+02	4.50E+02	2.993	
8	4.43E-04	3.42E+02	3.44E+02	-0.840	
9	5.64E-04	2.50E+02	2.57E+02	-2.914	
10	7.13E-04	1.85E+02	1.94E+02	-4.779	
11	8.81E-04	1.43E+02	1.51E+02	-5.180	
12	8.90E-04	1.35E+02	1.50E+02	-9.928	
13	1.10E-03	1.12E+02	1.17E+02	-4.628	
14	1.10E-03	1.02E+02	1.17E+02	-12.370	
15	1.40E-03	7.94E+01	8.86E+01	-10.354	
16	1.41E-03	8.63E+01	8.78E+01	-1.656	
17	1.77E-03	6.27E+01	6.81E+01	-7.858	
18	2.20E-03	5.05E+01	5.36E+01	-5.785	
19	2.80E-03	4.12E+01	4.14E+01	-0.511	
20	3.55E-03	3.27E+01	3.24E+01	1.030	
21	4.43E-03	2.75E+01	2.59E+01	6.154	
22	5.64E-03	2.28E+01	2.05E+01	11.110	

R: 76. X: 0. Y: 76. DL: 152. REQ: 84. CF: 1.0000
CLHZ ARRAY, 22 DATA POINTS, RAMP: 115.0 MICROSEC, DATA: LC26
0511 LC 2600NZ OPR XTL L 6 12+100
Ch.21 = 0.115 Ch.22 = 0.89 Ch.23 = 19 Ch.24 = 2
RMS LOG ERROR: 7.50E-02, ANTILOG YIELDS 18.8536 %
LATE TIME PARAMETERS

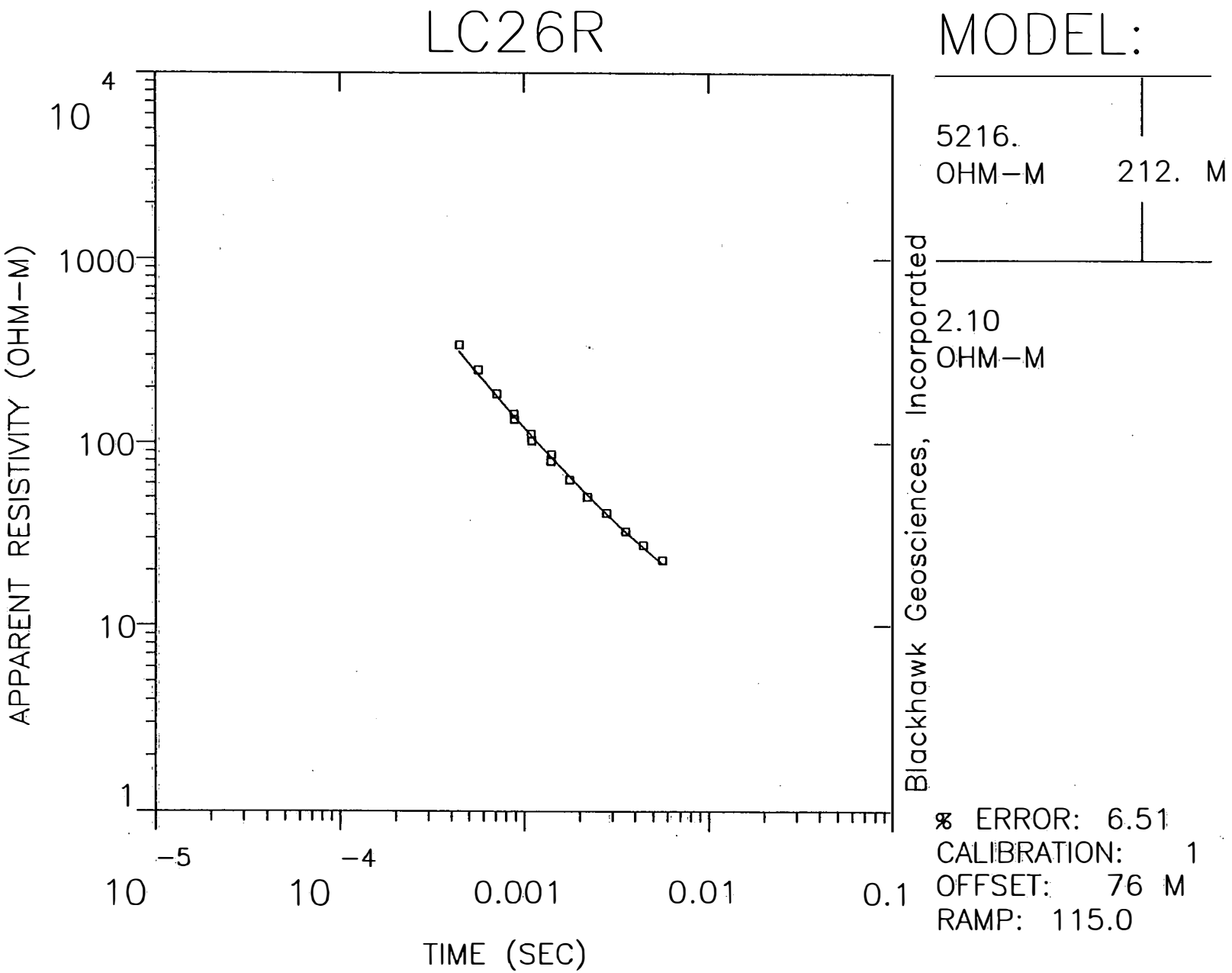
* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.38				
P 2	0.09	0.03			
P 3	-0.03	-0.01	0.07		
T 1	-0.41	-0.10	0.05	0.44	
T 2	0.01	0.01	-0.06	0.01	0.97
	P 1	P 2	P 3	T 1	T 2

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	10.748	20.253	33.437
	2	691.421	1286.101	4067.009
	3	0.290	1.139	2.077
THICK	1	1.790	4.267	8.060
	2	191.961	209.749	219.157
DEPTH	1	1.790	4.267	8.060
	2	196.527	214.016	223.367


LC26R
MODEL:
5216.
OHM-M
212. M
2.10
OHM-M
APPARENT RESISTIVITY (OHM-M)
TIME (SEC)
Blackhawk Geosciences, Incorporated
% ERROR: 6.51
CALIBRATION: 1
OFFSET: 76 M
RAMP: 115.0

LC26R

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		171.9	564.0		
5215.88	212.1	-40.2	-131.9	0.0	0.0
2.10					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	4.43E-04	3.42E+02	3.15E+02	8.324	
2	5.64E-04	2.50E+02	2.35E+02	6.022	
3	7.13E-04	1.85E+02	1.79E+02	3.712	
4	8.81E-04	1.43E+02	1.40E+02	2.621	
5	8.90E-04	1.35E+02	1.38E+02	-2.552	
6	1.10E-03	1.12E+02	1.09E+02	2.352	
7	1.10E-03	1.02E+02	1.09E+02	-5.972	
8	1.40E-03	7.94E+01	8.35E+01	-4.968	
9	1.41E-03	8.63E+01	8.28E+01	4.207	
10	1.77E-03	6.27E+01	6.51E+01	-3.693	
11	2.20E-03	5.05E+01	5.21E+01	-3.009	
12	2.80E-03	4.12E+01	4.10E+01	0.502	
13	3.55E-03	3.27E+01	3.27E+01	-0.057	
14	4.43E-03	2.75E+01	2.67E+01	2.782	
15	5.64E-03	2.28E+01	2.17E+01	4.932	

R: 76. X: 0. Y: 76. DL: 152. REQ: 84. CF: 1.0000
CLHZ ARRAY, 15 DATA POINTS, RAMP: 115.0 MICROSEC, DATA: LC26R
0511 LC 2600NZ OPR XTL L 6 12+100
Ch.21 = 0.115 Ch.22 = 0.89 Ch.23 = 19 Ch.24 = 2
RMS LOG ERROR: 2.74E-02, ANTILOG YIELDS 6.5142 %
LATE TIME PARAMETERS

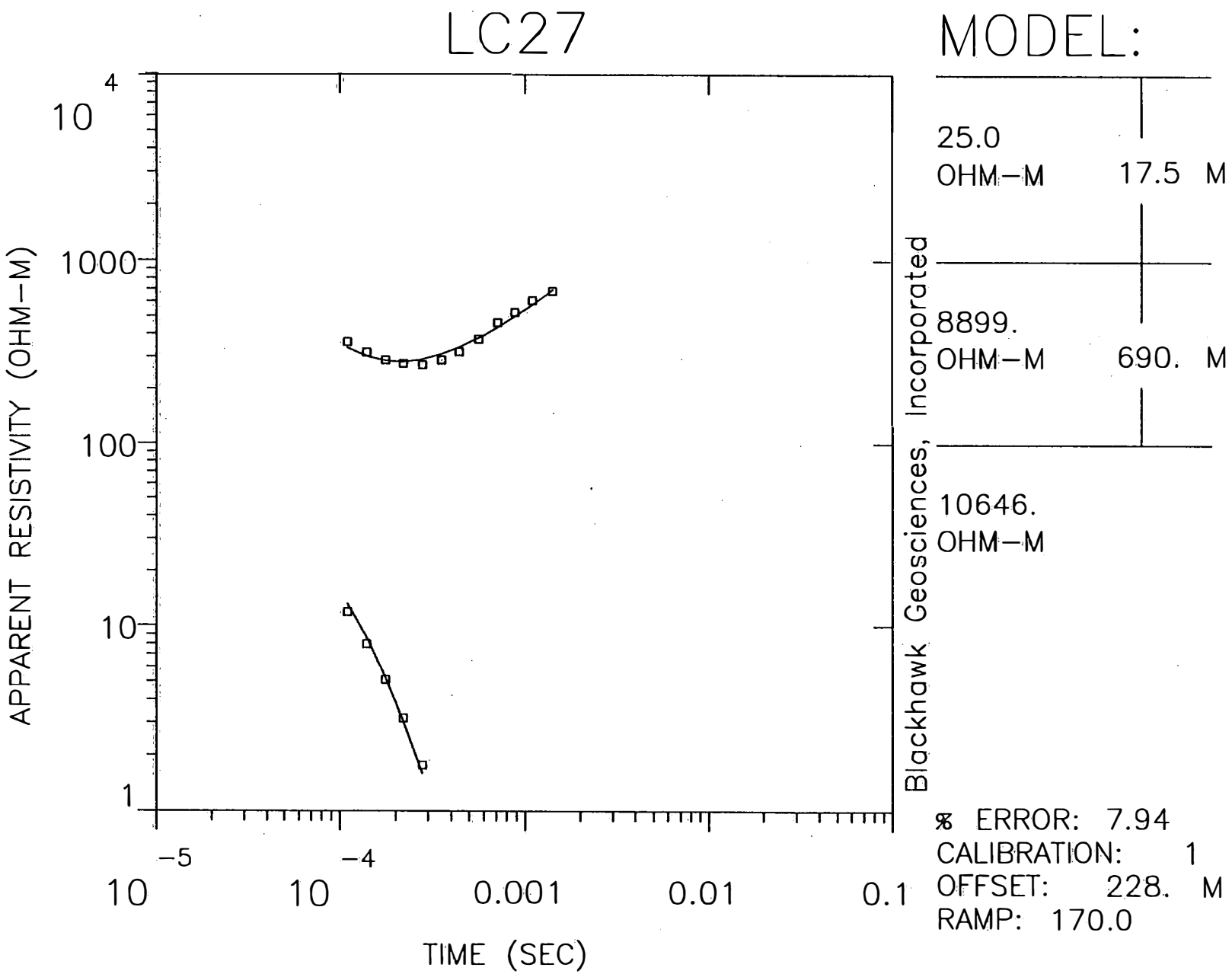
* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.12		
P 2	-0.04	0.99	
T 1	0.00	0.00	1.00
	P 1	P 2	T 1

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	326.803	5215.875	29111.789
	2	1.413	2.099	2.593
THICK	1	209.995	212.115	216.881
DEPTH	1	209.995	212.115	216.881



MODEL:

25.0 OHM-M — 17.5 M

8899. OHM-M — 690. M

10646. OHM-M

% ERROR: 7.94
CALIBRATION: 1
OFFSET: 228. M
RAMP: 170.0

LC27

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	(FEET)	CONDUCTANCE (S) LAYER	TOTAL
		850.1	2789.0		
24.96	17.5	832.5	2731.5	0.7	0.7
8898.91	690.3	142.3	466.8	0.1	0.8
10645.62					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	1.10E-04	3.62E+02	3.37E+02	7.427	
2	1.40E-04	3.17E+02	3.01E+02	5.267	
3	1.77E-04	2.87E+02	2.84E+02	1.041	
4	2.20E-04	2.75E+02	2.81E+02	-2.338	
5	2.80E-04	2.71E+02	2.90E+02	-6.496	
6	3.55E-04	2.88E+02	3.10E+02	-7.082	
7	4.43E-04	3.20E+02	3.38E+02	-5.424	
8	5.64E-04	3.74E+02	3.81E+02	-1.817	
9	7.13E-04	4.62E+02	4.36E+02	5.984	
10	8.81E-04	5.26E+02	4.98E+02	5.599	
11	1.10E-03	6.09E+02	5.78E+02	5.416	
12	1.41E-03	6.82E+02	6.93E+02	-1.520	

R: 228. X: 0. Y: 229. DL: 457. REQ: 254. CF: 1.0000
CLHZ ARRAY, 12 DATA POINTS, RAMP: 170.0 MICROSEC, DATA: LC27
0611 LC 2700NZ OPR XTL H 3 8 +100
Ch.21 = 0.17 Ch.22 = 0.089 Ch.23 = 11 Ch.24 = 2
RMS LOG ERROR: 3.32E-02, ANTILOG YIELDS 7.9420 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

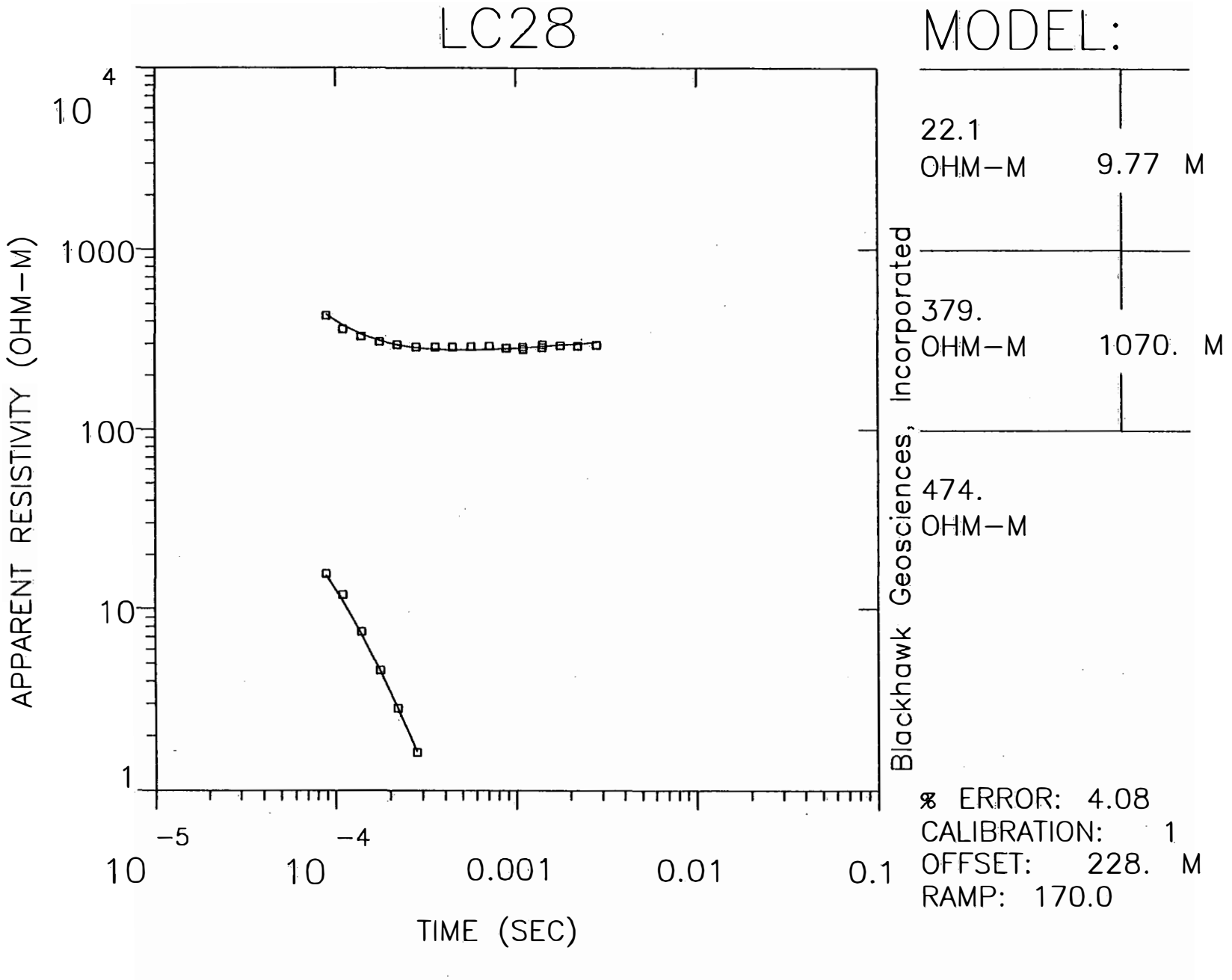
PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.80				
P 2	-0.10	0.10			
P 3	-0.01	0.02	0.01		
T 1	-0.22	-0.14	-0.02	0.76	
T 2	0.01	-0.01	0.00	0.01	0.00
	P 1	P 2	P 3	T 1	T 2

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	13.810	24.961	45.116
	2	5004.227	8898.914	28140.838
	3	1064.562	10645.619	106456.187
THICK	1	9.302	17.541	33.078

	2	6.903	690.263	6902.633
DEPTH	1	9.302	17.541	33.078
	2	25.441	707.804	6919.696


LC28
MODEL:
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
22.1
OHM-M
9.77 M
379.
OHM-M
1070. M
474.
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 4.08
CALIBRATION: 1
OFFSET: 228. M
RAMP: 170.0

LC28

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		590.1	1936.0		
22.07	9.8	580.3	1904.0	0.4	0.4
379.16	1070.5	-490.1	-1608.1	2.8	3.3
474.39					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	4.28E+02	4.35E+02	-1.615	
2	1.10E-04	3.61E+02	3.80E+02	-5.007	
3	1.40E-04	3.29E+02	3.38E+02	-2.769	
4	1.77E-04	3.08E+02	3.12E+02	-1.189	
5	2.20E-04	2.97E+02	2.96E+02	0.371	
6	2.80E-04	2.88E+02	2.85E+02	0.912	
7	3.55E-04	2.87E+02	2.80E+02	2.804	
8	4.43E-04	2.88E+02	2.77E+02	3.723	
9	5.64E-04	2.89E+02	2.77E+02	4.235	
10	7.13E-04	2.92E+02	2.79E+02	4.408	
11	8.81E-04	2.85E+02	2.82E+02	0.922	
12	8.90E-04	2.84E+02	2.82E+02	0.443	
13	1.10E-03	2.88E+02	2.86E+02	0.764	
14	1.10E-03	2.78E+02	2.86E+02	-2.678	
15	1.40E-03	2.86E+02	2.90E+02	-1.646	
16	1.41E-03	2.96E+02	2.91E+02	1.957	
17	1.77E-03	2.94E+02	2.95E+02	-0.530	
18	2.20E-03	2.91E+02	3.00E+02	-3.019	
19	2.80E-03	2.95E+02	3.06E+02	-3.637	

R: 228. X: 0. Y: 229. DL: 457. REQ: 254. CF: 1.0000
CLHZ ARRAY, 19 DATA POINTS, RAMP: 170.0 MICROSEC, DATA: LC28
0611 LC 2800NZ OPR XTL L 6 12+100
Ch.21 = 0.17 Ch.22 = 0.89 Ch.23 = 11 Ch.24 = 20
RMS LOG ERROR: 1.74E-02, ANTILOG YIELDS 4.0799 %
LATE TIME PARAMETERS

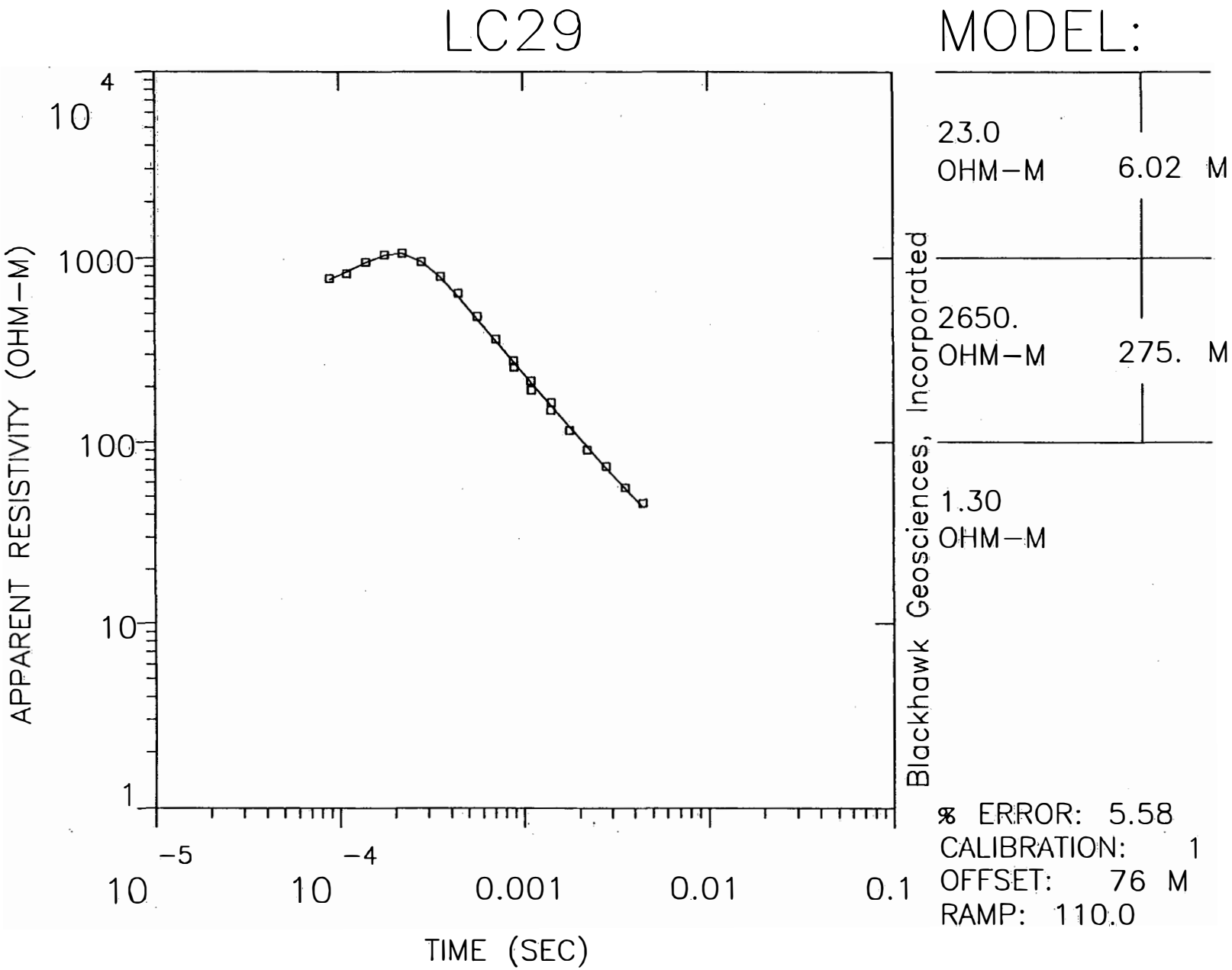
* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.49				
P 2	0.04	0.85			
P 3	0.00	-0.01	0.00		
T 1	-0.45	-0.09	0.00	0.43	
T 2	0.00	0.01	0.00	0.00	0.00
	P 1	P 2	P 3	T 1	T 2

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	17.340	22.068	27.978
	2	359.863	379.163	407.373
	3	150.014	474.387	98212.359
THICK	1	7.210	9.769	13.236
	2	601.967	1070.466	1070465.120
DEPTH	1	7.210	9.769	13.236
	2	611.740	1080.235	1070474.870


LC29
MODEL:
APPARENT RESISTIVITY (OHM-M)
10 4
1000
100
10
1
10 -5
10 -4
0.001
0.01
0.1
TIME (SEC)
23.0
OHM-M
6.02 M
2650.
OHM-M
275. M
1.30
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 5.58
CALIBRATION: 1
OFFSET: 76 M
RAMP: 110.0

LC29

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		245.1	804.0		
22.98	6.0	239.0	784.3	0.3	0.3
2649.85	274.9	-35.8	-117.5	0.1	0.4
1.30					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	7.76E+02	7.60E+02	2.102	
2	1.10E-04	8.24E+02	8.39E+02	-1.768	
3	1.40E-04	9.47E+02	9.45E+02	0.255	
4	1.77E-04	1.04E+03	1.03E+03	0.095	
5	2.20E-04	1.06E+03	1.05E+03	0.637	
6	2.80E-04	9.55E+02	9.56E+02	-0.067	
7	3.55E-04	7.92E+02	7.83E+02	1.066	
8	4.43E-04	6.42E+02	6.17E+02	3.972	
9	5.64E-04	4.82E+02	4.65E+02	3.699	
10	7.13E-04	3.64E+02	3.52E+02	3.662	
11	8.81E-04	2.78E+02	2.73E+02	1.671	
12	8.90E-04	2.56E+02	2.70E+02	-5.087	
13	1.10E-03	2.16E+02	2.11E+02	2.602	
14	1.10E-03	1.92E+02	2.10E+02	-8.322	
15	1.40E-03	1.49E+02	1.58E+02	-5.858	
16	1.41E-03	1.64E+02	1.57E+02	4.903	
17	1.77E-03	1.16E+02	1.21E+02	-4.067	
18	2.20E-03	9.08E+01	9.43E+01	-3.680	
19	2.80E-03	7.34E+01	7.21E+01	1.756	
20	3.55E-03	5.61E+01	5.58E+01	0.608	
21	4.43E-03	4.61E+01	4.41E+01	4.459	

R: 76. X: 0. Y: 76. DL: 152. REQ: 84. CF: 1.0000
CLHZ ARRAY, 21 DATA POINTS, RAMP: 110.0 MICROSEC, DATA: LC29
0711 LC 2900NZ OPR XTL L 6 12+100
Ch.21 = 0.11 Ch.22 = 0.89 Ch.23 = 19 Ch.24 = 23
RMS LOG ERROR: 2.36E-02, ANTILOG YIELDS 5.5842 %
LATE TIME PARAMETERS

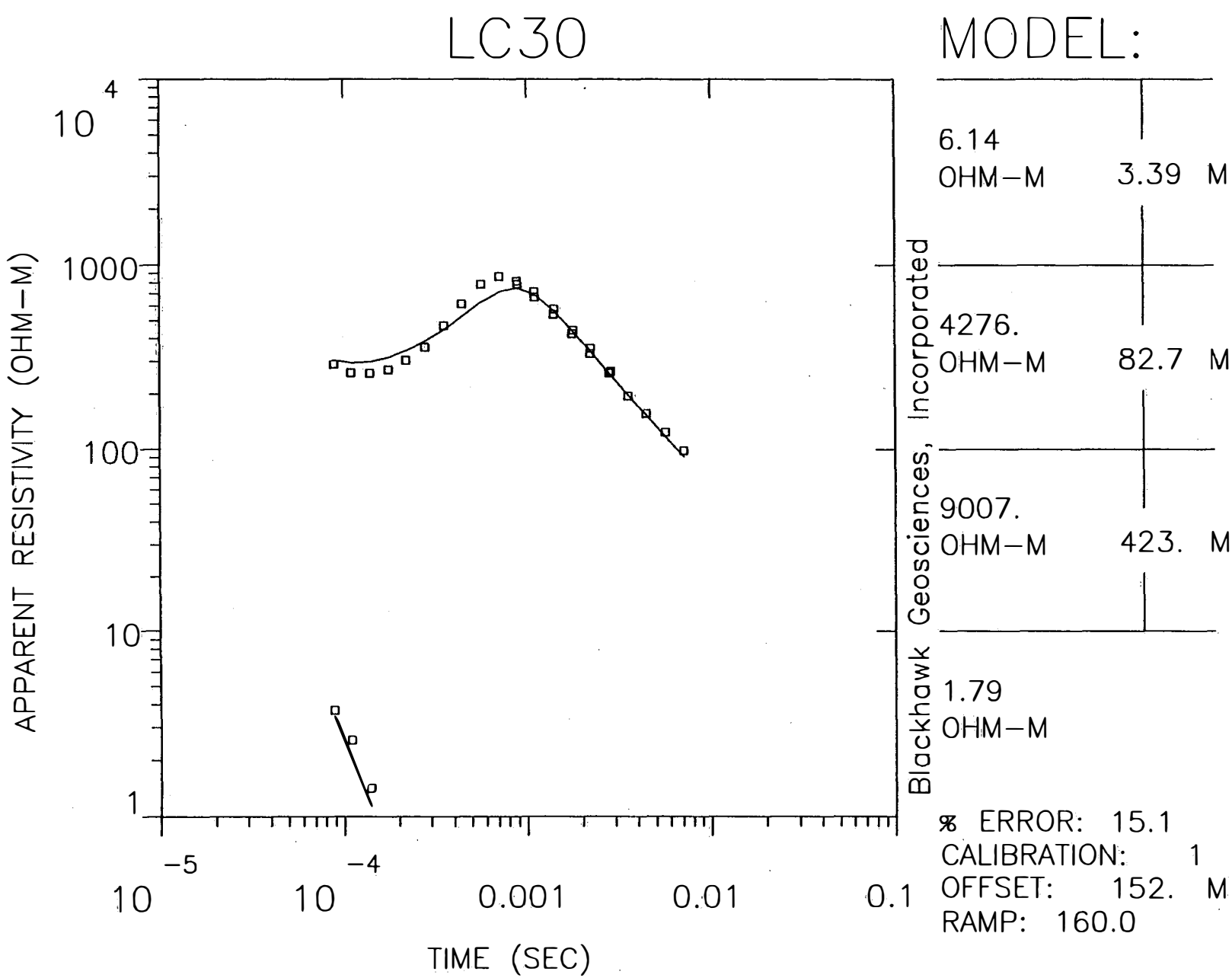
* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.97				
P 2	-0.06	0.42			
P 3	0.01	-0.02	0.98		
T 1	-0.04	-0.14	0.01	0.94	
T 2	0.00	0.00	0.00	0.00	1.00
	P 1	P 2	P 3	T 1	T 2

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	18.365	22.985	32.138
	2	1585.397	2649.850	4912.727
	3	0.881	1.299	1.666
THICK	1	4.556	6.016	9.112
	2	264.226	274.870	282.234
DEPTH	1	4.556	6.016	9.112
	2	273.338	280.886	286.790


LC30
MODEL:
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
6.14
OHM-M
3.39 M
4276.
OHM-M
82.7 M
9007.
OHM-M
423. M
1.79
OHM-M
% ERROR: 15.1
CALIBRATION: 1
OFFSET: 152. M
RAMP: 160.0
Blackhawk Geosciences, Incorporated

LC30

MODEL: 4 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		495.0	1624.0		
6.14	3.4	491.6	1612.9	0.6	0.6
4275.89	82.7	409.0	1341.7	0.0	0.6
9006.57	422.8	-13.8	-45.3	0.0	0.6
1.79					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	2.90E+02	3.05E+02	-4.928	
2	1.10E-04	2.60E+02	2.96E+02	-12.186	
3	1.40E-04	2.60E+02	3.00E+02	-13.521	
4	1.77E-04	2.71E+02	3.16E+02	-14.267	
5	2.20E-04	3.04E+02	3.42E+02	-11.190	
6	2.80E-04	3.59E+02	3.86E+02	-6.989	
7	3.55E-04	4.72E+02	4.47E+02	5.412	
8	4.43E-04	6.18E+02	5.25E+02	17.818	
9	5.64E-04	7.87E+02	6.28E+02	25.175	
10	7.13E-04	8.68E+02	7.22E+02	20.216	
11	8.81E-04	8.18E+02	7.51E+02	8.960	
12	8.90E-04	7.89E+02	7.50E+02	5.260	
13	1.10E-03	7.21E+02	6.95E+02	3.681	
14	1.10E-03	6.71E+02	6.93E+02	-3.169	
15	1.40E-03	5.43E+02	5.69E+02	-4.533	
16	1.41E-03	5.80E+02	5.65E+02	2.727	
17	1.77E-03	4.27E+02	4.43E+02	-3.570	
18	1.80E-03	4.44E+02	4.36E+02	1.887	
19	2.20E-03	3.31E+02	3.45E+02	-4.085	
20	2.22E-03	3.55E+02	3.41E+02	4.325	
21	2.80E-03	2.60E+02	2.61E+02	-0.249	
22	2.85E-03	2.66E+02	2.55E+02	4.119	
23	3.55E-03	1.96E+02	1.98E+02	-1.138	
24	4.43E-03	1.56E+02	1.54E+02	1.392	
25	5.64E-03	1.24E+02	1.18E+02	5.228	
26	7.13E-03	9.80E+01	9.09E+01	7.861	

R: 152. X: 0. Y: 153. DL: 305. REQ: 170. CF: 1.0000
CLHZ ARRAY, 26 DATA POINTS, RAMP: 160.0 MICROSEC, DATA: LC30
0711 LC 3000NZ OPR XTL L 6 12+100
Ch.21 = 0.16 Ch.22 = 0.89 Ch.23 = 15 Ch.24 = 93
RMS LOG ERROR: 6.10E-02, ANTILOG YIELDS 15.0899 %
LATE TIME PARAMETERS

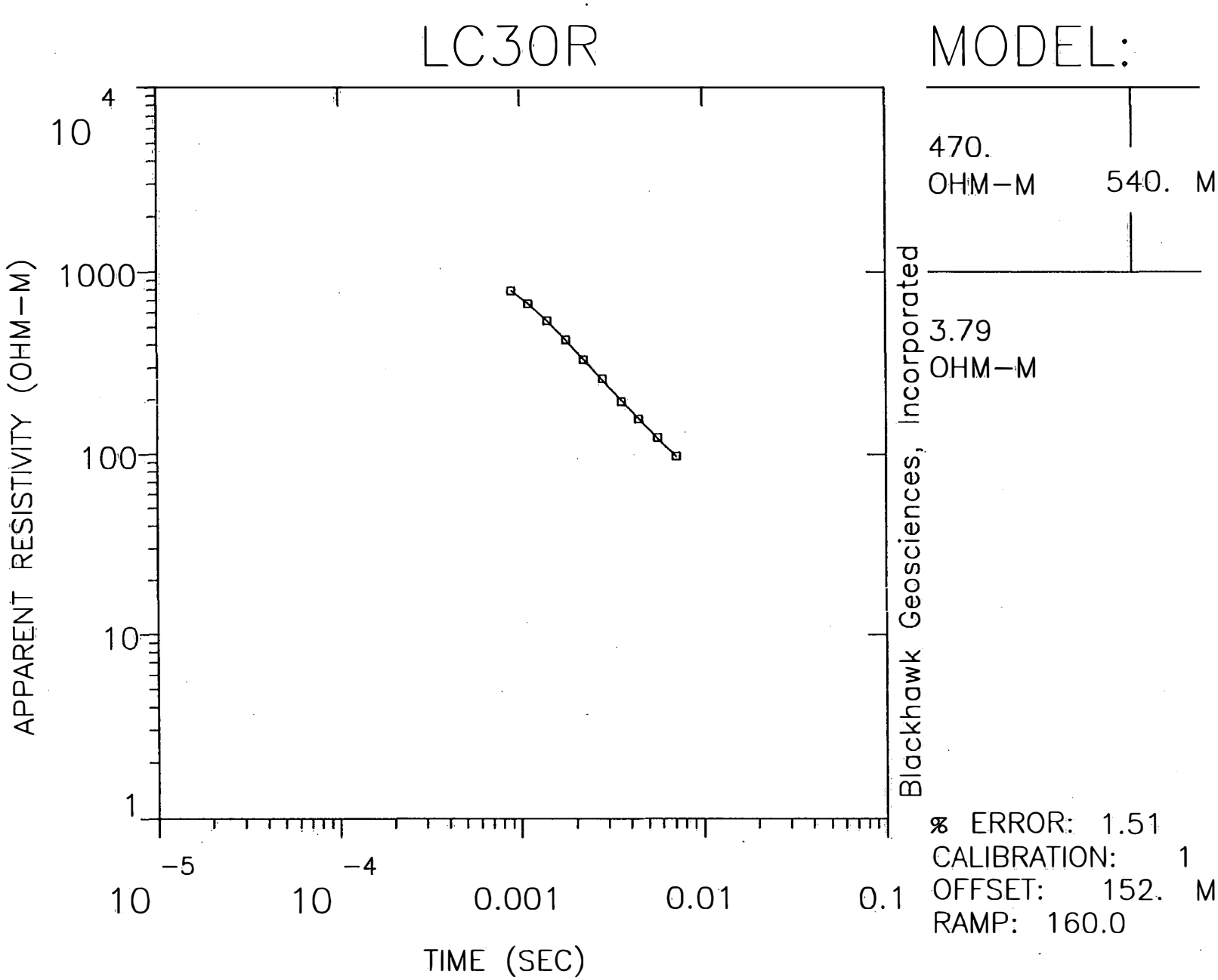
* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER
P 1 0.79

P 2	-0.01	0.01					
P 3	-0.03	0.01	0.01				
P 4	0.18	-0.01	-0.02	0.32			
T 1	-0.22	-0.04	-0.04	0.19	0.78		
T 2	-0.02	0.00	0.00	-0.03	-0.01	0.05	
T 3	0.02	0.00	0.00	-0.06	0.02	0.20	0.95
	P 1	P 2	P 3	P 4	T 1	T 2	T 3

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	2.530	6.137	18.398
	2	1352.156	4275.893	42758.930
	3	2848.128	9006.570	90065.672
	4	0.280	1.787	4.911
THICK	1	1.369	3.387	10.359
	2	43.220	82.653	161.052
	3	357.491	422.771	493.274
DEPTH	1	1.369	3.387	10.359
	2	46.581	86.040	164.649
	3	440.617	508.810	551.395


LC30R
MODEL:
470.
OHM-M
540. M
3.79
OHM-M
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
Blackhawk Geosciences, Incorporated
% ERROR: 1.51
CALIBRATION: 1
OFFSET: 152. M
RAMP: 160.0

LC30R

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		495.0	1624.0		
470.15	540.4	-45.4	-148.8	1.1	1.1
3.79					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-04	7.89E+02	7.89E+02	0.054	
2	1.10E-03	6.71E+02	6.76E+02	-0.608	
3	1.40E-03	5.43E+02	5.39E+02	0.800	
4	1.77E-03	4.27E+02	4.22E+02	1.178	
5	2.20E-03	3.31E+02	3.34E+02	-0.962	
6	2.80E-03	2.60E+02	2.57E+02	1.081	
7	3.55E-03	1.96E+02	2.00E+02	-1.800	
8	4.43E-03	1.56E+02	1.58E+02	-1.084	
9	5.64E-03	1.24E+02	1.23E+02	0.536	
10	7.13E-03	9.80E+01	9.72E+01	0.858	

R: 152. X: 0. Y: 153. DL: 305. REQ: 170. CF: 1.0000
CLHZ ARRAY, 10 DATA POINTS, RAMP: 160.0 MICROSEC, DATA: LC30R
0711 LC 3000NZ OPR XTL L 6 12+100
Ch.21 = 0.16 Ch.22 = 0.89 Ch.23 = 15 Ch.24 = 93
RMS LOG ERROR: 6.51E-03, ANTILOG YIELDS 1.5092 %
LATE TIME PARAMETERS

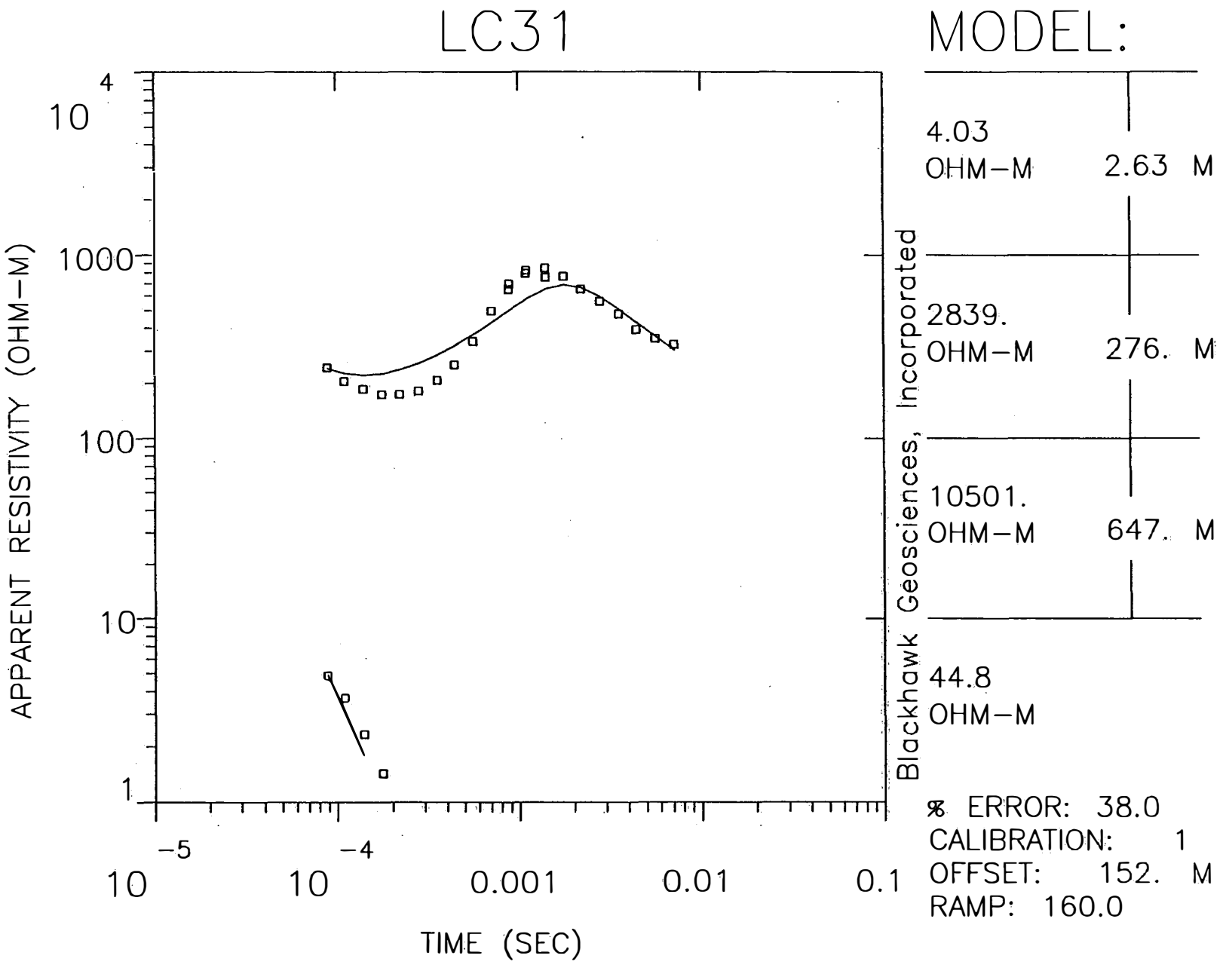
* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	1.00		
P 2	-0.01	0.98	
T 1	0.00	0.00	1.00
	P 1	P 2	T 1

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	447.226	470.153	496.175
	2	3.298	3.785	4.386
THICK	1	535.750	540.365	544.748
DEPTH	1	535.750	540.365	544.748


LC31
MODEL:
4.03
OHM-M
2.63 M
2839.
OHM-M
276. M
10501.
OHM-M
647. M
44.8
OHM-M
% ERROR: 38.0
CALIBRATION: 1
OFFSET: 152. M
RAMP: 160.0
Blackhawk Geosciences, Incorporated
APPARENT RESISTIVITY (OHM-M)
TIME (SEC)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1

LC31

MODEL: 4 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		595.0	1952.0		
4.03	2.6	592.3	1943.4	0.7	0.7
2839.04	275.7	316.6	1038.8	0.1	0.8
10501.33	646.8	-330.2	-1083.3	0.1	0.8
44.84					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	2.43E+02	2.42E+02	0.773	
2	1.10E-04	2.05E+02	2.27E+02	-9.536	
3	1.40E-04	1.86E+02	2.22E+02	-15.957	
4	1.77E-04	1.74E+02	2.26E+02	-22.787	
5	2.20E-04	1.74E+02	2.37E+02	-26.461	
6	2.80E-04	1.81E+02	2.57E+02	-29.587	
7	3.55E-04	2.07E+02	2.86E+02	-27.418	
8	4.43E-04	2.52E+02	3.21E+02	-21.360	
9	5.64E-04	3.40E+02	3.70E+02	-7.927	
10	7.13E-04	4.98E+02	4.30E+02	15.677	
11	8.81E-04	6.51E+02	4.98E+02	30.765	
12	8.90E-04	6.99E+02	5.01E+02	39.456	
13	1.10E-03	7.97E+02	5.76E+02	38.464	
14	1.10E-03	8.29E+02	5.77E+02	43.760	
15	1.40E-03	8.54E+02	6.54E+02	30.596	
16	1.41E-03	7.58E+02	6.56E+02	15.547	
17	1.77E-03	7.67E+02	6.89E+02	11.333	
18	2.20E-03	6.57E+02	6.68E+02	-1.676	
19	2.80E-03	5.63E+02	5.99E+02	-6.007	
20	3.55E-03	4.78E+02	5.11E+02	-6.384	
21	4.43E-03	3.94E+02	4.34E+02	-9.344	
22	5.64E-03	3.53E+02	3.64E+02	-2.916	
23	7.13E-03	3.27E+02	3.05E+02	7.163	

R: 152. X: 0. Y: 153. DL: 305. REQ: 170. CF: 1.0000
CLHZ ARRAY, 23 DATA POINTS, RAMP: 160.0 MICROSEC, DATA: LC31
0811 LC 3100NZ OPR XTL L 6 12+100
Ch.21 = 0.16 Ch.22 = 0.89 Ch.23 = 15 Ch.24 = 93
RMS LOG ERROR: 1.40E-01, ANTILOG YIELDS 38.0080 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

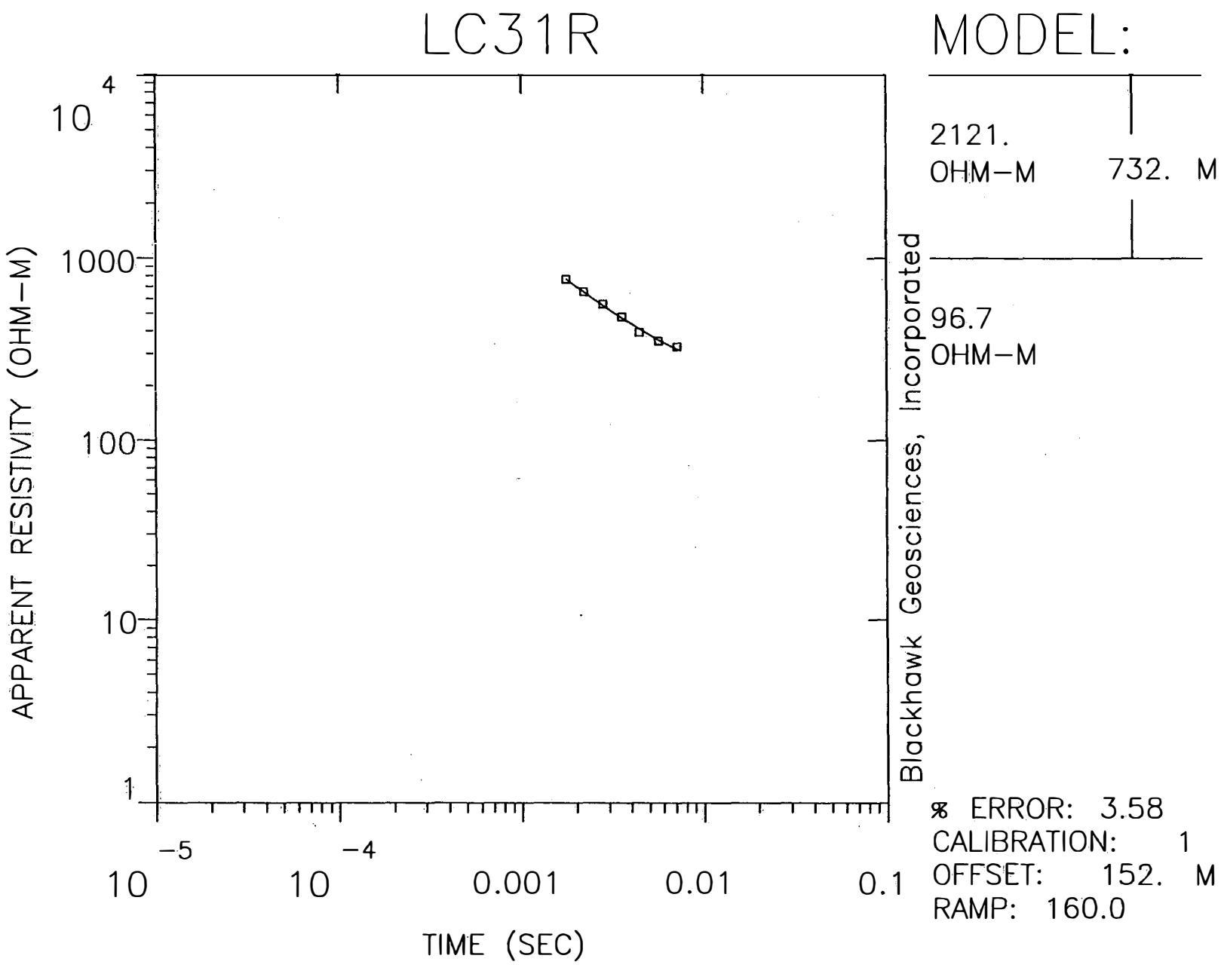
PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.50						
P 2	0.02	0.02					
P 3	0.00	0.00	0.00				
P 4	0.00	-0.01	0.00	0.03			
T 1	-0.48	-0.04	0.00	0.02	0.50		
T 2	-0.01	0.00	0.00	0.03	0.00	0.13	
T 3	-0.01	0.02	0.01	0.05	-0.03	0.29	0.67

P 1 P 2 P 3 P 4 T 1 T 2 T 3

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	1.390	4.026	11.661
	2	1596.510	2839.040	28390.402
	3	3320.812	10501.329	105013.289
	4	14.181	44.843	141.806
THICK	1	0.912	2.633	7.599
	2	83.197	275.705	542.911
	3	301.994	646.822	966.865
DEPTH	1	0.912	2.633	7.599
	2	85.829	278.338	545.340
	3	847.335	925.160	1052.695


LC31R
MODEL:
2121.
OHM-M
732. M
96.7
OHM-M
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
Blackhawk Geosciences, Incorporated
% ERROR: 3.58
CALIBRATION: 1
OFFSET: 152. M
RAMP: 160.0

LC31R

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		595.0	1952.0		
2121.12	732.0	-137.0	-449.6	0.3	0.3
96.68					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	1.77E-03	7.67E+02	7.70E+02	-0.416	
2	2.20E-03	6.57E+02	6.55E+02	0.360	
3	2.80E-03	5.63E+02	5.53E+02	1.928	
4	3.55E-03	4.78E+02	4.72E+02	1.228	
5	4.43E-03	3.94E+02	4.12E+02	-4.488	
6	5.64E-03	3.53E+02	3.59E+02	-1.585	
7	7.13E-03	3.27E+02	3.17E+02	3.108	

R: 152. X: 0. Y: 153. DL: 305. REQ: 170. CF: 1.0000
CLHZ ARRAY, 7 DATA POINTS, RAMP: 160.0 MICROSEC, DATA: LC31R
0811 LC 3100NZ OPR XTL L 6 12+100
Ch.21 = 0.16 Ch.22 = 0.89 Ch.23 = 15 Ch.24 = 93
RMS LOG ERROR: 1.53E-02, ANTILOG YIELDS 3.5778 %
LATE TIME PARAMETERS

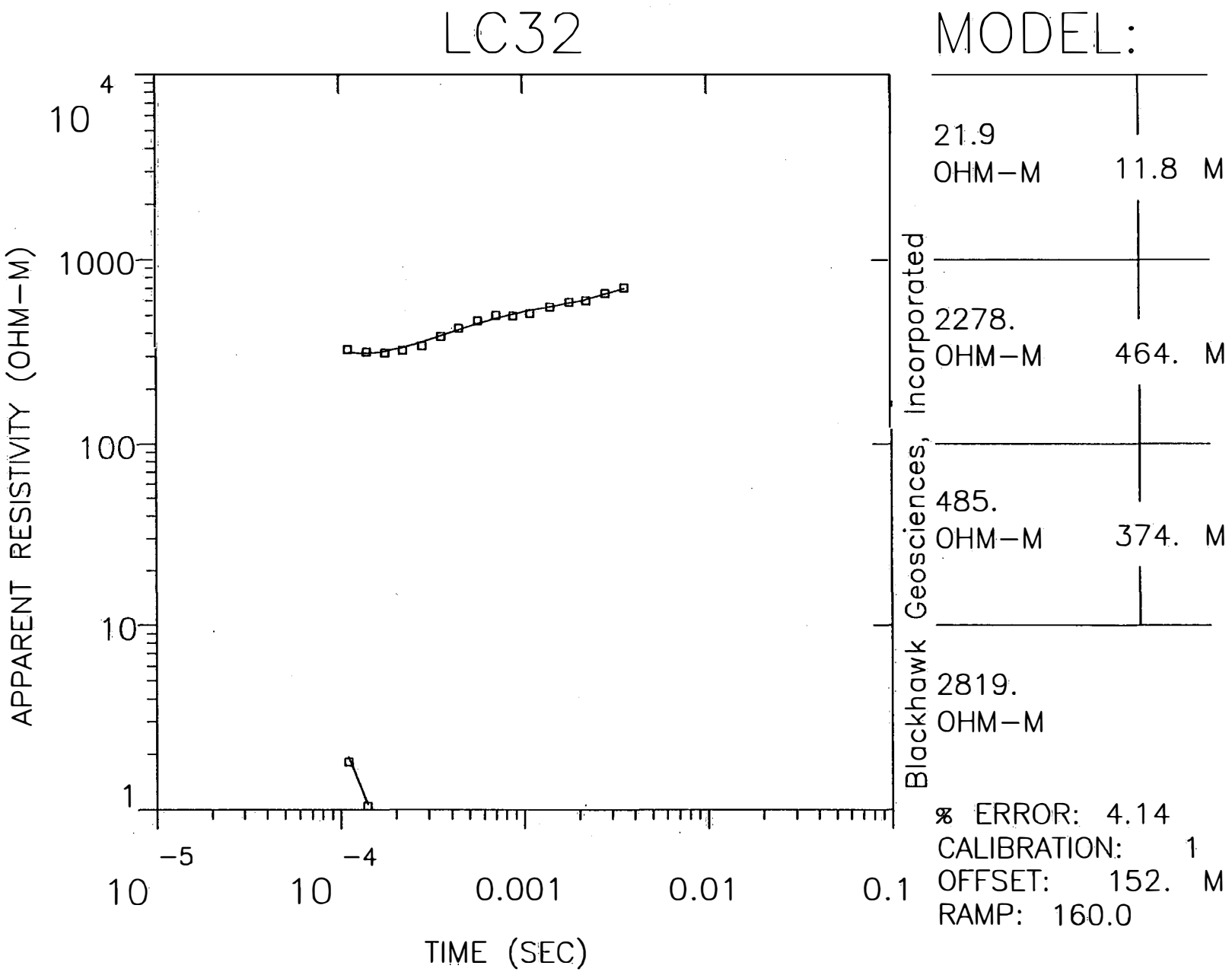
* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.02		
P 2	-0.06	0.95	
T 1	0.08	0.02	0.99
	P 1	P 2	T 1

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	1149.013	2121.119	4699.542
	2	84.586	96.682	109.479
THICK	1	681.345	732.004	786.199
DEPTH	1	681.345	732.004	786.199


LC32
MODEL:
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
21.9
OHM-M
11.8 M
2278.
OHM-M
464. M
485.
OHM-M
374. M
2819.
OHM-M
% ERROR: 4.14
CALIBRATION: 1
OFFSET: 152. M
RAMP: 160.0
Blackhawk Geosciences, Incorporated

LC32

MODEL: 4 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		439.8	1443.0		
21.94	11.8	428.0	1404.2	0.5	0.5
2277.99	464.0	-36.0	-118.2	0.2	0.7
485.13	373.9	-410.0	-1345.0	0.8	1.5
2819.05					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	1.10E-04	3.28E+02	3.14E+02	4.347	
2	1.40E-04	3.18E+02	3.12E+02	1.711	
3	1.77E-04	3.13E+02	3.20E+02	-2.312	
4	2.20E-04	3.23E+02	3.35E+02	-3.354	
5	2.80E-04	3.42E+02	3.58E+02	-4.353	
6	3.55E-04	3.84E+02	3.87E+02	-0.763	
7	4.43E-04	4.27E+02	4.17E+02	2.504	
8	5.64E-04	4.69E+02	4.51E+02	3.813	
9	7.13E-04	5.00E+02	4.83E+02	3.602	
10	8.81E-04	4.97E+02	5.09E+02	-2.195	
11	1.10E-03	5.12E+02	5.32E+02	-3.715	
12	1.41E-03	5.54E+02	5.59E+02	-0.770	
13	1.80E-03	5.89E+02	5.86E+02	0.556	
14	2.20E-03	6.00E+02	6.12E+02	-1.978	
15	2.80E-03	6.61E+02	6.55E+02	0.870	
16	3.55E-03	7.06E+02	6.98E+02	1.096	

R: 152. X: 0. Y: 153. DL: 305. REQ: 170. CF: 1.0000
CLHZ ARRAY, 16 DATA POINTS, RAMP: 160.0 MICROSEC, DATA: LC32
0811 LC 3200NZ OPR XTL L 6 12+100
Ch.21 = 0.16 Ch.22 = 0.89 Ch.23 = 15 Ch.24 = 93
RMS LOG ERROR: 1.76E-02, ANTILOG YIELDS 4.1436 %
LATE TIME PARAMETERS

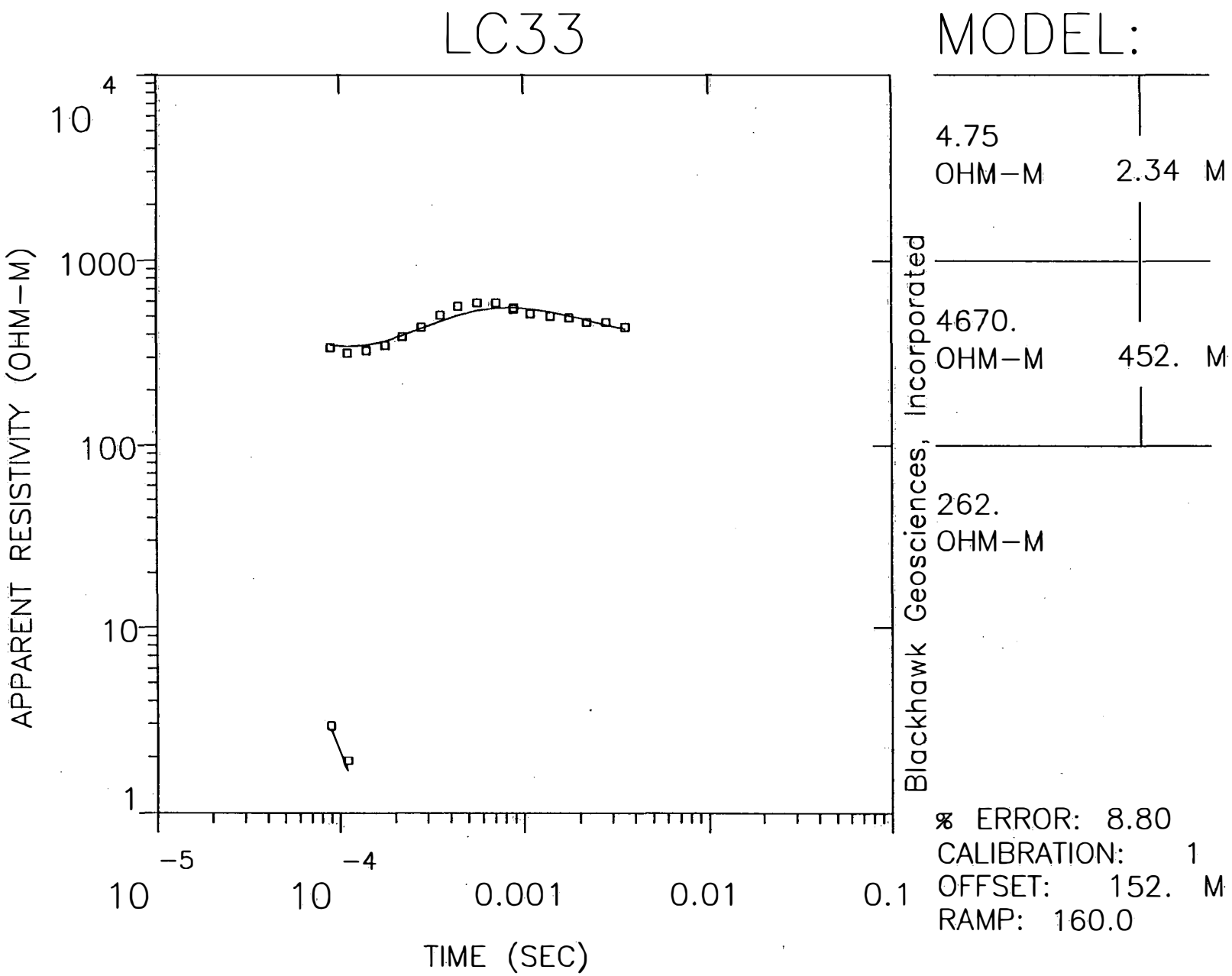
* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.67						
P 2	-0.12	0.24					
P 3	0.02	0.09	0.62				
P 4	-0.01	0.02	0.08	0.06			
T 1	-0.35	-0.19	0.03	-0.01	0.61		
T 2	-0.09	0.22	0.17	-0.09	-0.09	0.68	
T 3	-0.03	-0.02	-0.40	-0.11	-0.03	0.12	0.36
	P 1	P 2	P 3	P 4	T 1	T 2	T 3

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	16.388	21.944	28.362
	2	1803.675	2277.991	3566.051
	3	306.958	485.127	696.079
	4	1314.509	2819.050	10434.339
THICK	1	8.620	11.839	15.648
	2	337.541	464.006	652.033
	3	187.141	373.937	654.032
DEPTH	1	8.620	11.839	15.648
	2	348.382	475.846	665.041
	3	729.728	849.783	1082.236


LC33
MODEL:
4.75
OHM-M
2.34 M
4670.
OHM-M
452. M
262.
OHM-M
% ERROR: 8.80
CALIBRATION: 1
OFFSET: 152. M
RAMP: 160.0
Blackhawk Geosciences, Incorporated
APPARENT RESISTIVITY (OHM-M)
TIME (SEC)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1

LC33

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		430.1	1411.0		
4.75	2.3	427.7	1403.3	0.5	0.5
4670.15	451.8	-24.1	-79.0	0.1	0.6
262.19					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	3.40E+02	3.51E+02	-3.080	
2	1.10E-04	3.17E+02	3.45E+02	-8.068	
3	1.40E-04	3.28E+02	3.52E+02	-6.825	
4	1.77E-04	3.50E+02	3.70E+02	-5.341	
5	2.20E-04	3.89E+02	3.95E+02	-1.482	
6	2.80E-04	4.37E+02	4.30E+02	1.574	
7	3.55E-04	5.08E+02	4.70E+02	8.004	
8	4.43E-04	5.64E+02	5.05E+02	11.608	
9	5.64E-04	5.91E+02	5.36E+02	10.178	
10	7.13E-04	5.90E+02	5.54E+02	6.562	
11	8.81E-04	5.45E+02	5.57E+02	-2.071	
12	8.90E-04	5.56E+02	5.57E+02	-0.029	
13	1.10E-03	5.15E+02	5.47E+02	-5.849	
14	1.40E-03	5.00E+02	5.26E+02	-4.863	
15	1.77E-03	4.91E+02	5.01E+02	-1.847	
16	2.20E-03	4.65E+02	4.77E+02	-2.478	
17	2.80E-03	4.64E+02	4.50E+02	3.154	
18	3.55E-03	4.36E+02	4.27E+02	2.100	

R: 152. X: 0. Y: 153. DL: 305. REQ: 170. CF: 1.0000
CLHZ ARRAY, 18 DATA POINTS, RAMP: 160.0 MICROSEC, DATA: LC33
0811 LC 3300NZ OPR XTL L 6 12+100
Ch.21 = 0.16 Ch.22 = 0.89 Ch.23 = 15 Ch.24 = 93
RMS LOG ERROR: 3.66E-02, ANTILOG YIELDS 8.7981 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

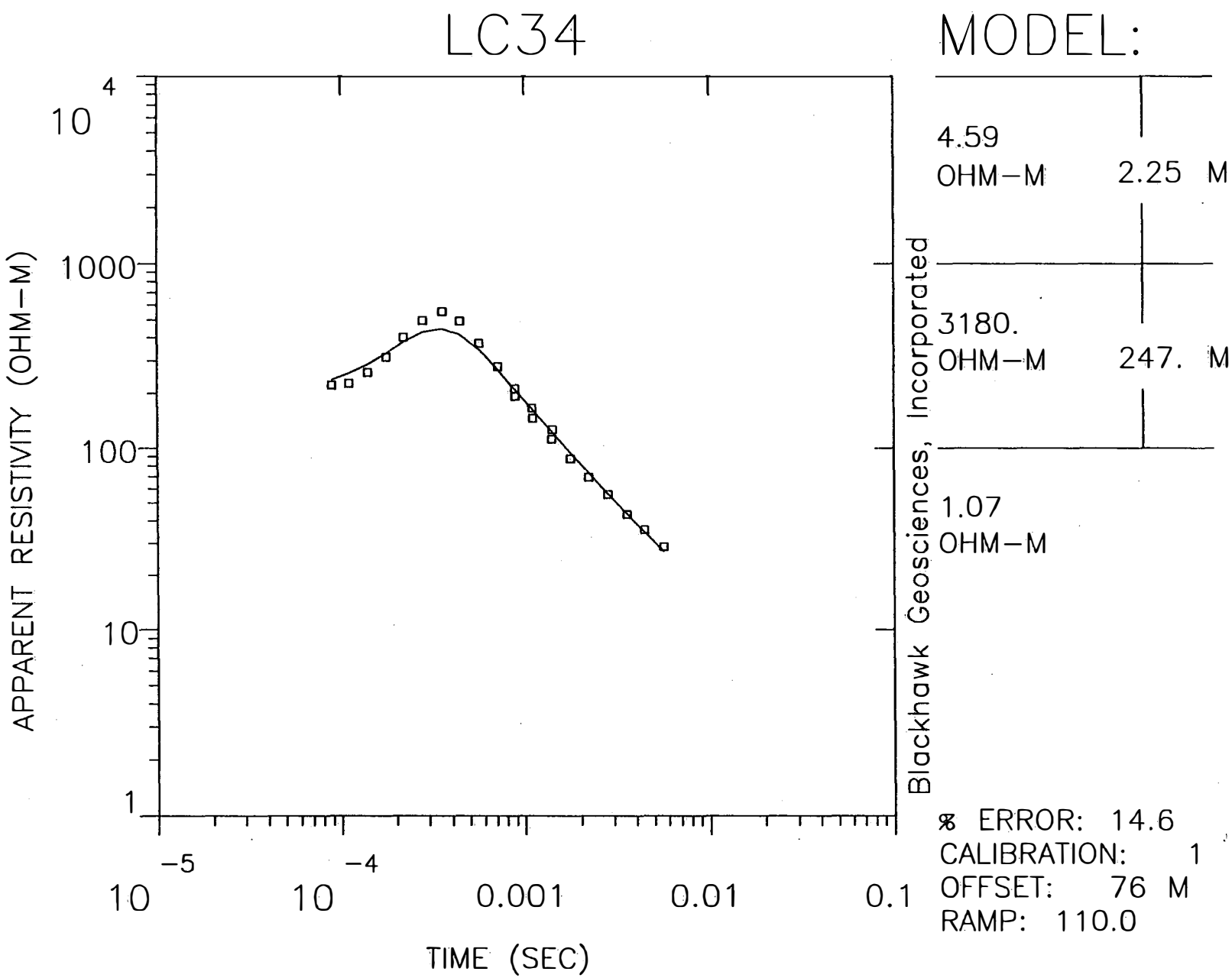
PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.49				
P 2	0.01	0.01			
P 3	-0.01	0.01	0.25		
T 1	-0.48	-0.03	0.00	0.50	
T 2	-0.02	0.05	0.27	-0.07	0.63
	P 1	P 2	P 3	T 1	T 2

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

LAYER	MINIMUM	BEST	MAXIMUM

RHO	1	2.623	4.749	8.327
	2	2727.498	4670.151	19470.463
	3	169.566	262.190	323.488
THICK	1	1.249	2.337	4.227
	2	403.632	451.804	530.306
DEPTH	1	1.249	2.337	4.227
	2	405.923	454.141	532.649


LC34
MODEL:
4.59
OHM-M
2.25 M
3180.
OHM-M
247. M
1.07
OHM-M
% ERROR: 14.6
CALIBRATION: 1
OFFSET: 76 M
RAMP: 110.0
Blackhawk Geosciences, Incorporated
APPARENT RESISTIVITY (OHM-M)
TIME (SEC)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1

LC34

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		232.0	761.0		
4.59	2.3	229.7	753.6	0.5	0.5
3180.39	246.9	-17.2	-56.3	0.1	0.6
1.07					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	2.21E+02	2.37E+02	-6.585	
2	1.10E-04	2.26E+02	2.56E+02	-11.827	
3	1.40E-04	2.59E+02	2.87E+02	-9.840	
4	1.77E-04	3.14E+02	3.29E+02	-4.677	
5	2.20E-04	4.00E+02	3.77E+02	6.081	
6	2.80E-04	4.98E+02	4.27E+02	16.579	
7	3.55E-04	5.52E+02	4.46E+02	23.911	
8	4.43E-04	4.86E+02	4.14E+02	17.325	
9	5.64E-04	3.73E+02	3.42E+02	9.121	
10	7.13E-04	2.79E+02	2.67E+02	4.290	
11	8.81E-04	2.12E+02	2.10E+02	1.185	
12	8.90E-04	1.92E+02	2.07E+02	-7.416	
13	1.10E-03	1.65E+02	1.63E+02	1.560	
14	1.10E-03	1.46E+02	1.62E+02	-10.109	
15	1.40E-03	1.12E+02	1.23E+02	-8.752	
16	1.41E-03	1.26E+02	1.22E+02	3.952	
17	1.77E-03	8.73E+01	9.39E+01	-6.998	
18	2.20E-03	6.93E+01	7.35E+01	-5.665	
19	2.80E-03	5.58E+01	5.64E+01	-1.060	
20	3.55E-03	4.34E+01	4.37E+01	-0.778	
21	4.43E-03	3.57E+01	3.47E+01	2.955	
22	5.64E-03	2.87E+01	2.71E+01	5.757	

R: 76. X: 0. Y: 76. DL: 152. REQ: 84. CF: 1.0000
CLHZ ARRAY, 22 DATA POINTS, RAMP: 110.0 MICROSEC, DATA: LC34
0911 LC 3400NZ OPR XTL L 6 12+100
Ch.21 = 0.11 Ch.22 = 0.89 Ch.23 = 19 Ch.24 = 23
RMS LOG ERROR: 5.92E-02, ANTILOG YIELDS 14.6085 %
LATE TIME PARAMETERS

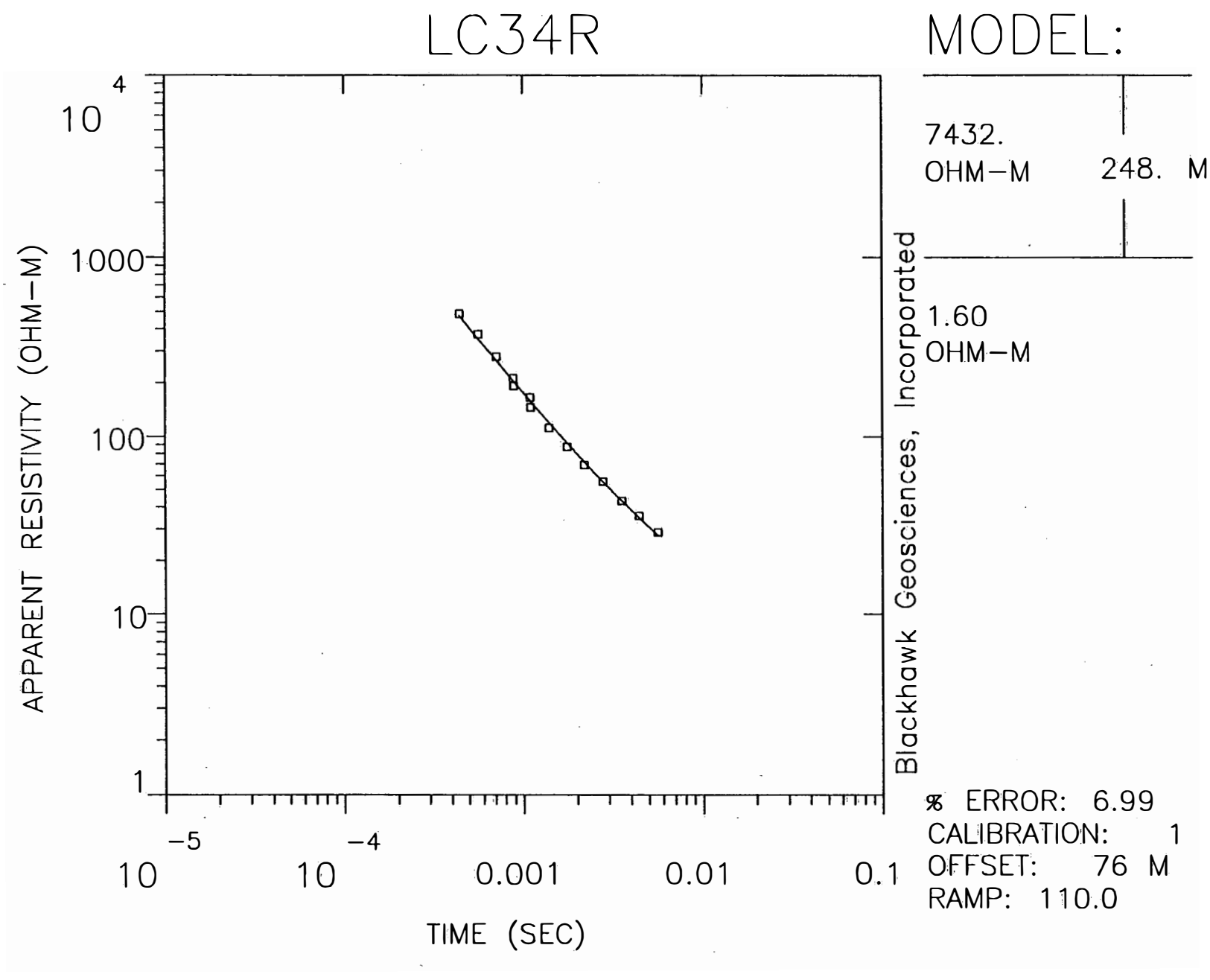
* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.55				
P 2	0.01	0.00			
P 3	0.05	-0.01	0.18		
T 1	-0.43	-0.03	0.07	0.56	
T 2	0.00	0.00	-0.06	0.00	0.99
	P 1	P 2	P 3	T 1	T 2

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	0.468	4.588	16.343
	2	1788.462	3180.385	31803.846
	3	0.236	1.069	1.977
THICK	1	0.223	2.250	8.142
	2	223.075	246.858	258.796
DEPTH	1	0.223	2.250	8.142
	2	225.637	249.108	261.010


LC34R
MODEL:
7432.
OHM-M
248. M
1.60
OHM-M
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
Blackhawk Geosciences, Incorporated
% ERROR: 6.99
CALIBRATION: 1
OFFSET: 76 M
RAMP: 110.0

LC34R

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		232.0	761.0		
7431.72	248.1	-16.2	-53.0	0.0	0.0
1.60					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	4.43E-04	4.86E+02	4.75E+02	2.164	
2	5.64E-04	3.73E+02	3.52E+02	5.985	
3	7.13E-04	2.79E+02	2.64E+02	5.478	
4	8.81E-04	2.12E+02	2.05E+02	3.666	
5	8.90E-04	1.92E+02	2.02E+02	-5.110	
6	1.10E-03	1.65E+02	1.58E+02	4.546	
7	1.10E-03	1.46E+02	1.58E+02	-7.464	
8	1.40E-03	1.12E+02	1.19E+02	-6.109	
9	1.77E-03	8.73E+01	9.15E+01	-4.546	
10	2.20E-03	6.93E+01	7.20E+01	-3.660	
11	2.80E-03	5.58E+01	5.56E+01	0.319	
12	3.55E-03	4.34E+01	4.35E+01	-0.170	
13	4.43E-03	3.57E+01	3.48E+01	2.489	
14	5.64E-03	2.87E+01	2.76E+01	3.958	

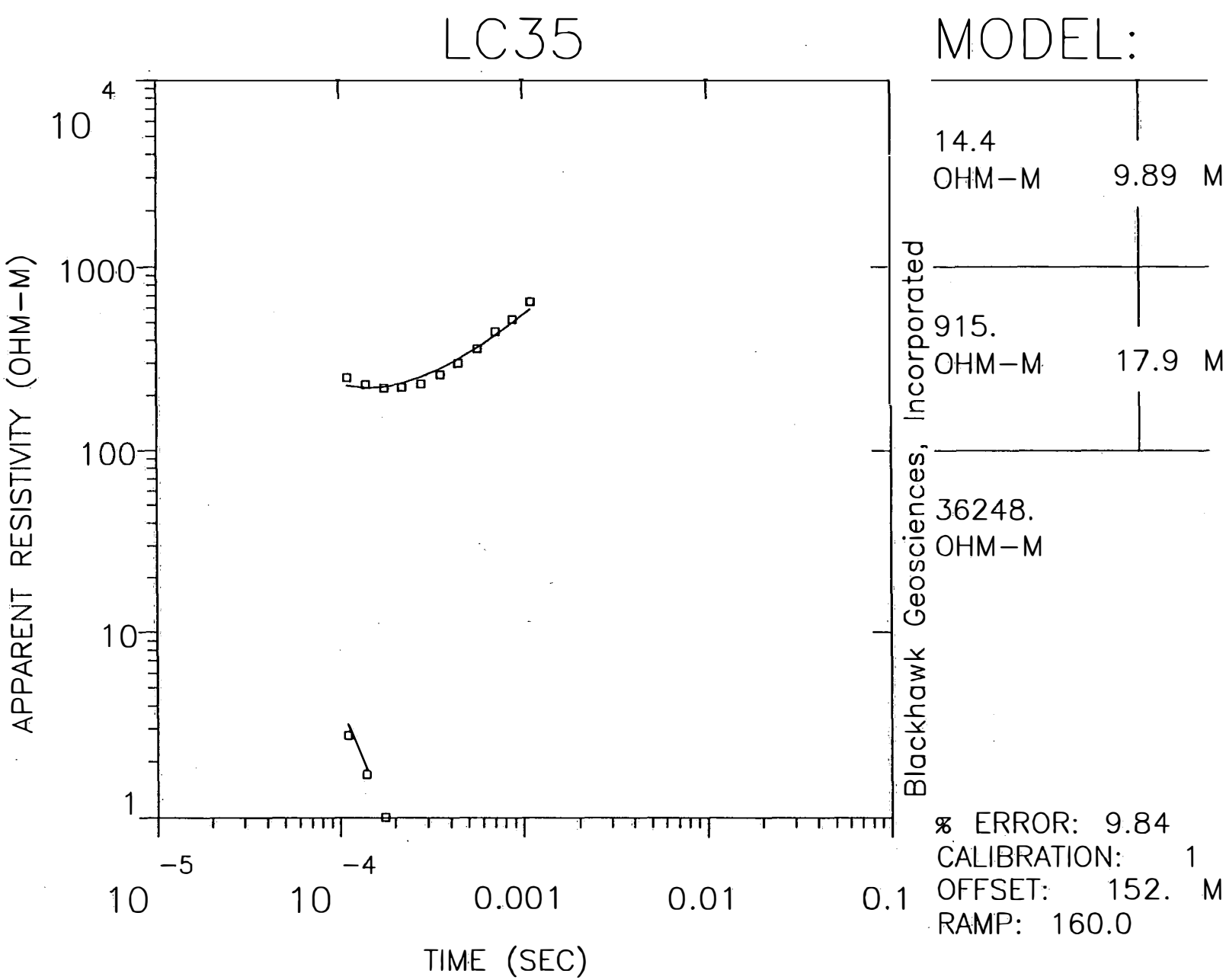
R: 76. X: 0. Y: 76. DL: 152. REQ: 84. CF: 1.0000
CLHZ ARRAY, 14 DATA POINTS, RAMP: 110.0 MICROSEC, DATA: LC34R
0911 LC 3400NZ OPR XTL L 6 12+100
Ch.21 = 0.11 Ch.22 = 0.89 Ch.23 = 19 Ch.24 = 23
RMS LOG ERROR: 2.93E-02, ANTILOG YIELDS 6.9861 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER
P 1 0.01
P 2 -0.01 0.99
T 1 0.00 0.00 1.00
P 1 P 2 T 1

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

LAYER		MINIMUM	BEST	MAXIMUM
RHO	1	560.678	7431.723	74317.227
	2	1.114	1.604	2.310
THICK	1	241.269	248.107	253.812
DEPTH	1	241.269	248.107	253.812


LC35
MODEL:
14.4
OHM-M
9.89 M
915.
OHM-M
17.9 M
36248.
OHM-M
% ERROR: 9.84
CALIBRATION: 1
OFFSET: 152. M
RAMP: 160.0
Blackhawk Geosciences, Incorporated
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)

LC35

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		534.9	1755.0		
14.38	9.9	525.0	1722.5	0.7	0.7
915.43	17.9	507.2	1663.9	0.0	0.7
36247.94					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	1.10E-04	2.49E+02	2.26E+02	10.091	
2	1.40E-04	2.29E+02	2.20E+02	4.483	
3	1.77E-04	2.20E+02	2.23E+02	-1.267	
4	2.20E-04	2.21E+02	2.33E+02	-5.064	
5	2.80E-04	2.30E+02	2.52E+02	-8.558	
6	3.55E-04	2.59E+02	2.80E+02	-7.305	
7	4.43E-04	2.99E+02	3.15E+02	-5.003	
8	5.64E-04	3.59E+02	3.64E+02	-1.422	
9	7.13E-04	4.45E+02	4.27E+02	4.284	
10	8.81E-04	5.20E+02	4.98E+02	4.461	
11	1.10E-03	6.48E+02	5.90E+02	9.815	

R: 152. X: 0. Y: 153. DL: 305. REQ: 170. CF: 1.0000
CLHZ ARRAY, 11 DATA POINTS, RAMP: 160.0 MICROSEC, DATA: LC35
0911 LC 3500NZ OPR XTL L 6 12+100
Ch.21 = 0.16 Ch.22 = 0.89 Ch.23 = 15 Ch.24 = 93
RMS LOG ERROR: 4.08E-02, ANTILOG YIELDS 9.8392 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

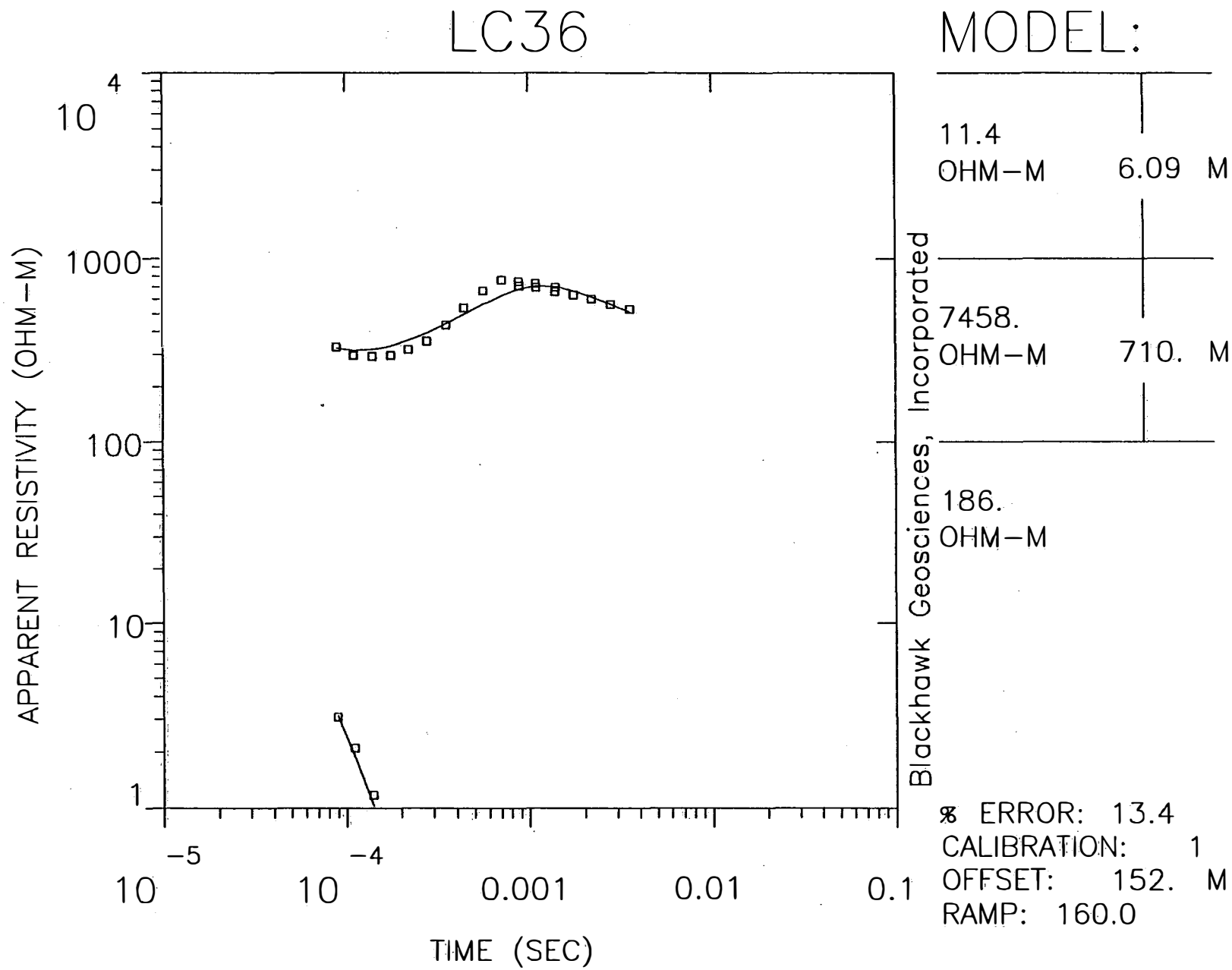
PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.70				
P 2	0.00	0.00			
P 3	-0.03	0.00	0.01		
T 1	-0.31	-0.03	-0.04	0.68	
T 2	0.01	0.00	0.00	0.04	0.00
	P 1	P 2	P 3	T 1	T 2

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	5.272	14.376	33.668
	2	309.470	915.435	2894.858
	3	7900.908	36247.941	362479.344
THICK	1	3.475	9.892	24.028
	2	5.650	17.867	56.501

DEPTH	1	3.475	9.892	24.028
	2	15.984	27.759	65.970


LC36
MODEL:
11.4
OHM-M
6.09 M
7458.
OHM-M
710. M
186.
OHM-M
% ERROR: 13.4
CALIBRATION: 1
OFFSET: 152. M
RAMP: 160.0
Blackhawk Geosciences, Incorporated
APPARENT RESISTIVITY (OHM-M)
TIME (SEC)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1

LC36

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		530.0	1739.0		
11.36	6.1	524.0	1719.0	0.5	0.5
7457.75	709.6	-185.6	-609.0	0.1	0.6
185.66					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	3.28E+02	3.25E+02	1.042	
2	1.10E-04	2.97E+02	3.17E+02	-6.131	
3	1.40E-04	2.93E+02	3.20E+02	-8.466	
4	1.77E-04	2.97E+02	3.34E+02	-11.069	
5	2.20E-04	3.19E+02	3.57E+02	-10.686	
6	2.80E-04	3.56E+02	3.93E+02	-9.536	
7	3.55E-04	4.34E+02	4.40E+02	-1.371	
8	4.43E-04	5.37E+02	4.95E+02	8.593	
9	5.64E-04	6.66E+02	5.63E+02	18.276	
10	7.13E-04	7.64E+02	6.32E+02	20.975	
11	8.81E-04	7.51E+02	6.82E+02	10.163	
12	8.90E-04	7.09E+02	6.84E+02	3.701	
13	1.10E-03	7.30E+02	7.09E+02	2.901	
14	1.10E-03	6.98E+02	7.10E+02	-1.614	
15	1.40E-03	6.60E+02	7.03E+02	-5.996	
16	1.41E-03	6.95E+02	7.02E+02	-0.992	
17	1.77E-03	6.33E+02	6.67E+02	-5.086	
18	2.20E-03	6.00E+02	6.19E+02	-3.085	
19	2.80E-03	5.63E+02	5.64E+02	-0.188	
20	3.55E-03	5.30E+02	5.12E+02	3.399	

R: 152. X: 0. Y: 153. DL: 305. REQ: 170. CF: 1.0000
CLHZ ARRAY, 20 DATA POINTS, RAMP: 160.0 MICROSEC, DATA: LC36
0911 LC 3600NZ OPR XTL L 6 12+100
Ch.21 = 0.16 Ch.22 = 0.89 Ch.23 = 15 Ch.24 = 93
RMS LOG ERROR: 5.46E-02, ANTILOG YIELDS 13.3943 %
LATE TIME PARAMETERS

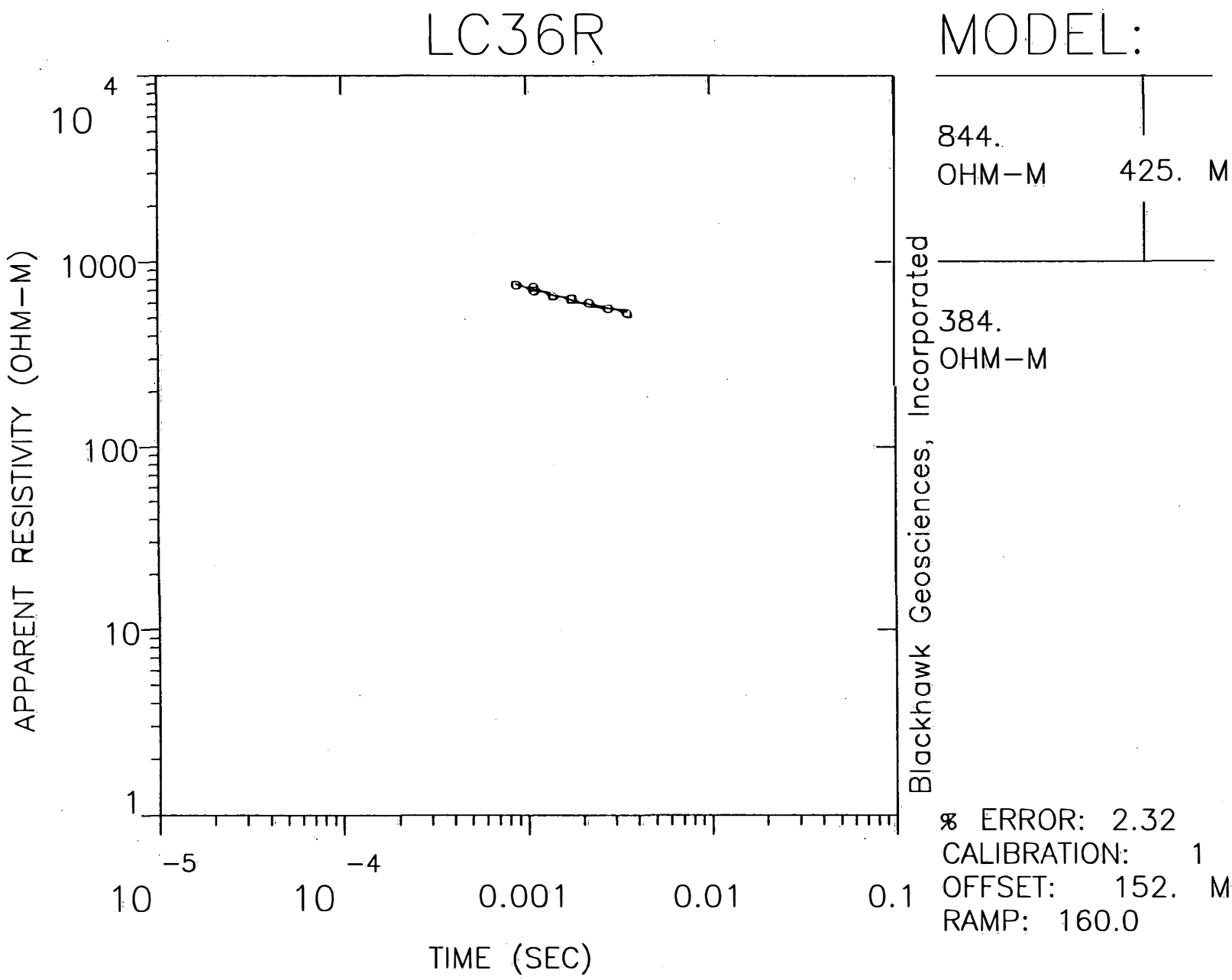
* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.51				
P 2	0.01	0.00			
P 3	0.00	0.00	0.07		
T 1	-0.47	-0.02	0.01	0.50	
T 2	-0.03	0.03	0.15	-0.07	0.74
	P 1	P 2	P 3	T 1	T 2

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	6.011	11.364	20.314
	2	3788.087	7457.746	58544.629
	3	69.924	185.659	305.177
THICK	1	3.094	6.092	11.305
	2	637.718	709.589	833.007
DEPTH	1	3.094	6.092	11.305
	2	643.644	715.682	839.185


LC36R
MODEL:
844.
OHM-M
425. M
384.
OHM-M
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
Blackhawk Geosciences, Incorporated
% ERROR: 2.32
CALIBRATION: 1
OFFSET: 152. M
RAMP: 160.0

LC36R

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		530.0	1739.0		
843.57	424.9	105.2	345.0	0.5	0.5
384.07					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.81E-04	7.51E+02	7.62E+02	-1.416	
2	1.10E-03	7.30E+02	7.11E+02	2.621	
3	1.10E-03	6.98E+02	7.11E+02	-1.749	
4	1.40E-03	6.60E+02	6.63E+02	-0.370	
5	1.77E-03	6.33E+02	6.24E+02	1.474	
6	2.20E-03	6.00E+02	5.93E+02	1.250	
7	2.80E-03	5.63E+02	5.63E+02	0.038	
8	3.55E-03	5.30E+02	5.39E+02	-1.728	

R: 152. X: 0. Y: 153. DL: 305. REQ: 170. CF: 1.0000
CLHZ ARRAY, 8 DATA POINTS, RAMP: 160.0 MICROSEC, DATA: LC36R
0911 LC 3600NZ OPR XTL L 6 12+100
Ch.21 = 0.16 Ch.22 = 0.89 Ch.23 = 15 Ch.24 = 93
RMS LOG ERROR: 9.96E-03, ANTILOG YIELDS 2.3199 %
LATE TIME PARAMETERS

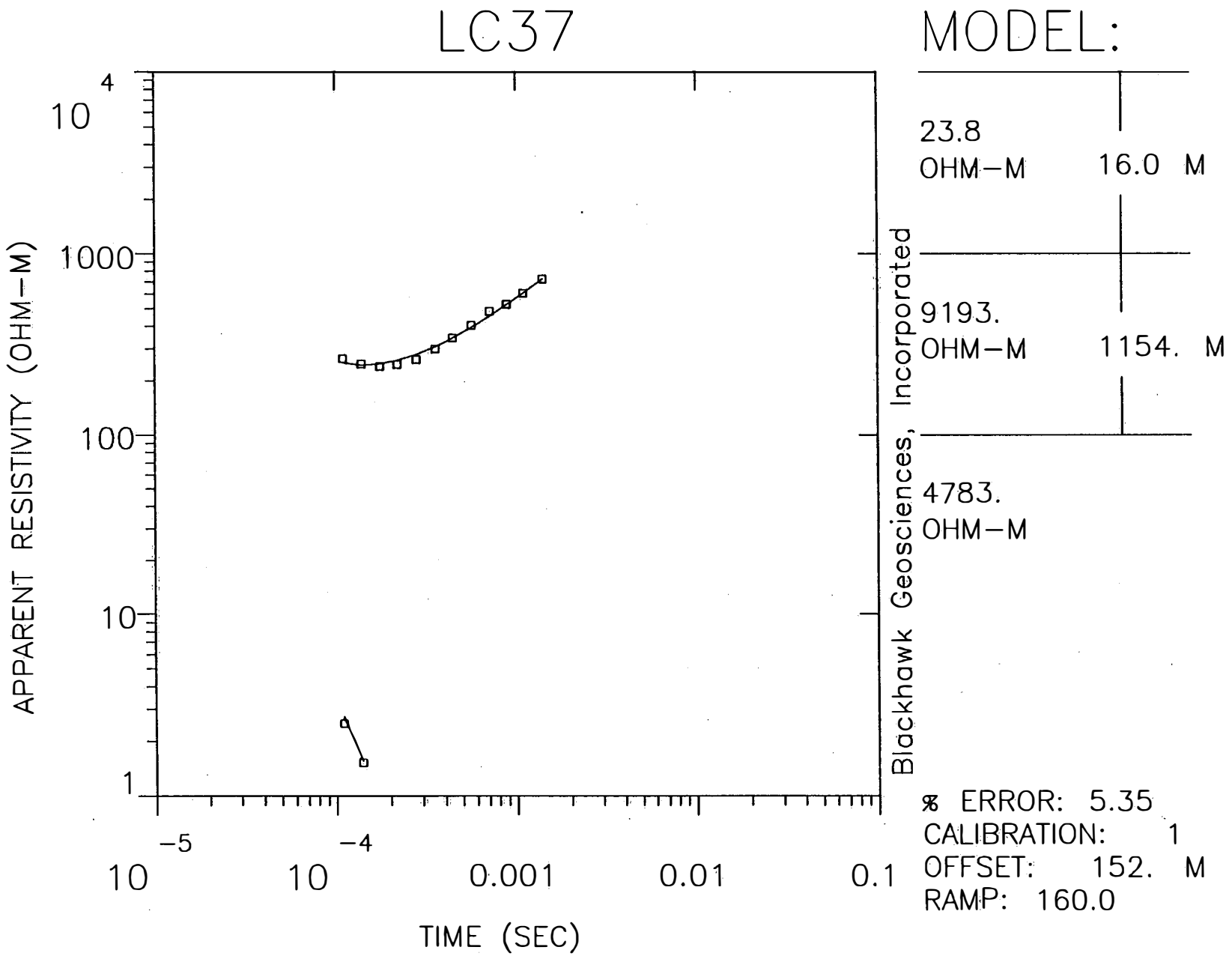
* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.47		
P 2	0.07	0.77	
T 1	0.40	0.19	0.37
	P 1	P 2	T 1

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	686.536	843.572	1013.322
	2	348.116	384.066	410.424
THICK	1	341.218	424.890	587.895
DEPTH	1	341.218	424.890	587.895


LC37
MODEL:
APPARENT RESISTIVITY (OHM-M)
10 4
1000
100
10
1
10 -5
10 -4
0.001
0.01
0.1
TIME (SEC)
23.8
OHM-M
16.0 M
9193.
OHM-M
1154. M
4783.
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 5.35
CALIBRATION: 1
OFFSET: 152. M
RAMP: 160.0

LC37

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		715.1	2346.0		
23.82	16.0	699.0	2293.4	0.7	0.7
9192.71	1153.6	-454.5	-1491.2	0.1	0.8
4783.35					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	1.10E-04	2.65E+02	2.50E+02	5.879	
2	1.40E-04	2.47E+02	2.44E+02	1.538	
3	1.77E-04	2.40E+02	2.47E+02	-3.012	
4	2.20E-04	2.46E+02	2.58E+02	-4.519	
5	2.80E-04	2.61E+02	2.78E+02	-5.900	
6	3.55E-04	2.98E+02	3.06E+02	-2.628	
7	4.43E-04	3.43E+02	3.42E+02	0.455	
8	5.64E-04	4.04E+02	3.92E+02	3.081	
9	7.13E-04	4.82E+02	4.54E+02	6.262	
10	8.81E-04	5.26E+02	5.23E+02	0.606	
11	8.90E-04	5.27E+02	5.26E+02	0.112	
12	1.10E-03	6.06E+02	6.08E+02	-0.271	
13	1.40E-03	7.22E+02	7.25E+02	-0.398	

R: 152. X: 0. Y: 153. DL: 305. REQ: 170. CF: 1.0000
CLHZ ARRAY, 13 DATA POINTS, RAMP: 160.0 MICROSEC, DATA: LC37
1011 LC 3700NZ OPR XTL L 6 12+100 1
Ch.21 = 0.16 Ch.22 = 0.89 Ch.23 = 15 Ch.24 = 93
RMS LOG ERROR: 2.26E-02, ANTILOG YIELDS 5.3457 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

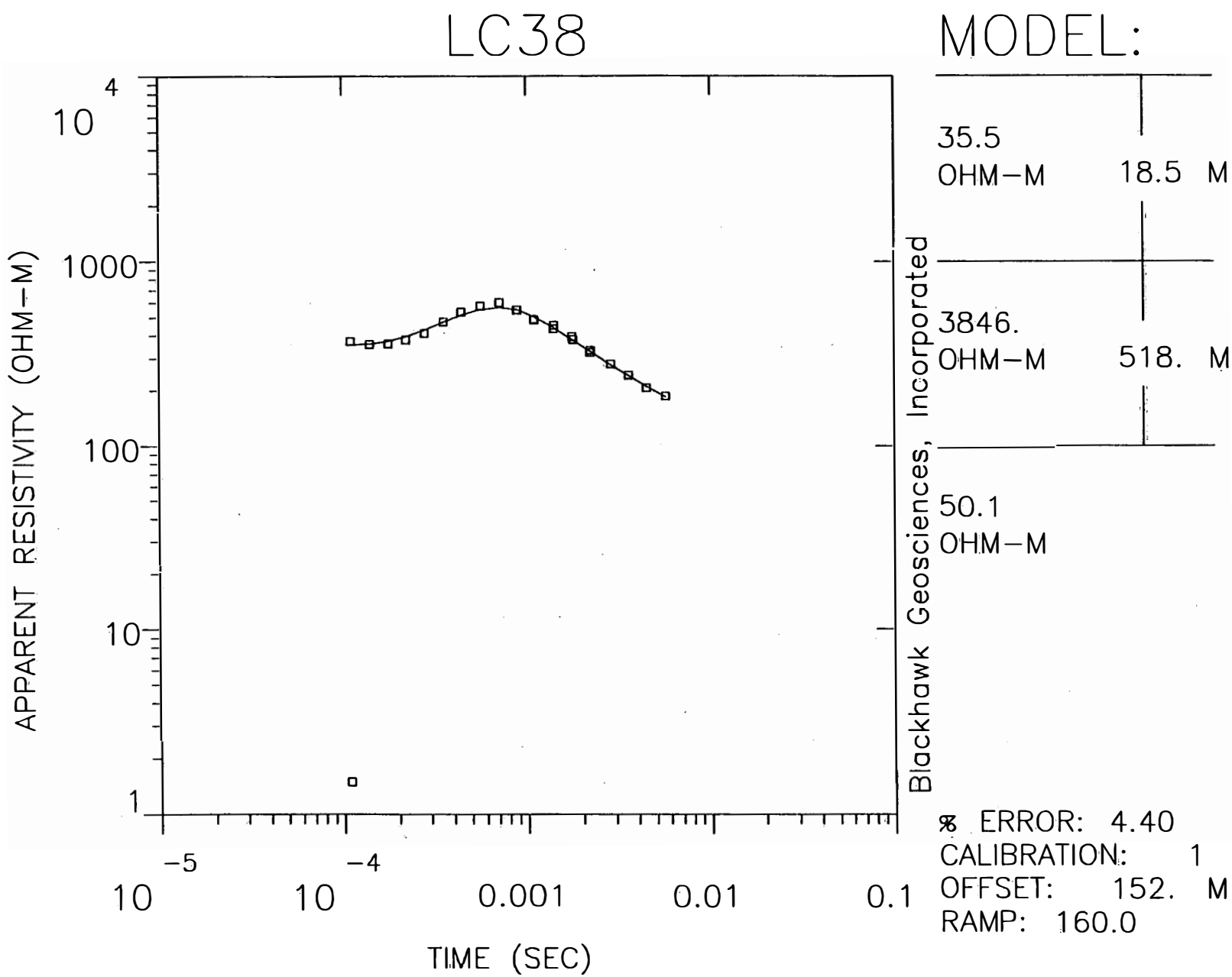
PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.77				
P 2	-0.12	0.12			
P 3	0.00	0.01	0.00		
T 1	-0.25	-0.15	-0.01	0.73	
T 2	-0.01	0.02	0.00	-0.01	0.00
	P 1	P 2	P 3	T 1	T 2

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	11.694	23.816	38.434
	2	6235.185	9192.709	16997.488
	3	47.834	4783.353	47833.531

THICK	1	7.530	16.022	26.701
	2	214.640	1153.554	11535.545
DEPTH	1	7.530	16.022	26.701
	2	230.280	1169.577	11552.105


LC38
MODEL:
35.5
OHM-M
18.5 M
3846.
OHM-M
518. M
50.1
OHM-M
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
Blackhawk Geosciences, Incorporated
% ERROR: 4.40
CALIBRATION: 1
OFFSET: 152. M
RAMP: 160.0

LC38

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	(FEET)	CONDUCTANCE (S) LAYER	TOTAL
		489.8	1607.0		
35.46	18.5	471.3	1546.4	0.5	0.5
3846.27	518.2	-46.9	-153.7	0.1	0.7
50.09					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	1.10E-04	3.72E+02	3.58E+02	3.808	
2	1.40E-04	3.60E+02	3.60E+02	0.066	
3	1.77E-04	3.60E+02	3.73E+02	-3.297	
4	2.20E-04	3.79E+02	3.94E+02	-3.863	
5	2.80E-04	4.12E+02	4.28E+02	-3.882	
6	3.55E-04	4.74E+02	4.71E+02	0.649	
7	4.43E-04	5.36E+02	5.15E+02	4.011	
8	5.64E-04	5.77E+02	5.55E+02	4.050	
9	7.13E-04	6.02E+02	5.68E+02	5.886	
10	8.81E-04	5.49E+02	5.50E+02	-0.121	
11	8.90E-04	5.49E+02	5.49E+02	0.021	
12	1.10E-03	4.89E+02	5.05E+02	-3.282	
13	1.10E-03	4.84E+02	5.05E+02	-4.168	
14	1.40E-03	4.34E+02	4.41E+02	-1.534	
15	1.41E-03	4.53E+02	4.39E+02	3.394	
16	1.77E-03	3.94E+02	3.79E+02	3.910	
17	1.80E-03	3.79E+02	3.75E+02	0.962	
18	2.20E-03	3.23E+02	3.28E+02	-1.333	
19	2.22E-03	3.31E+02	3.25E+02	1.854	
20	2.85E-03	2.78E+02	2.77E+02	0.617	
21	3.55E-03	2.42E+02	2.41E+02	0.657	
22	4.43E-03	2.07E+02	2.11E+02	-1.935	
23	5.64E-03	1.86E+02	1.85E+02	0.532	

R: 152. X: 0. Y: 153. DL: 305. REQ: 170. CF: 1.0000
CLHZ ARRAY, 23 DATA POINTS, RAMP: 160.0 MICROSEC, DATA: LC38
1011 LC 3800NZ OPR XTL L 6 12+100
Ch.21 = 0.16 Ch.22 = 0.89 Ch.23 = 15 Ch.24 = 93
RMS LOG ERROR: 1.87E-02, ANTILOG YIELDS 4.3970 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

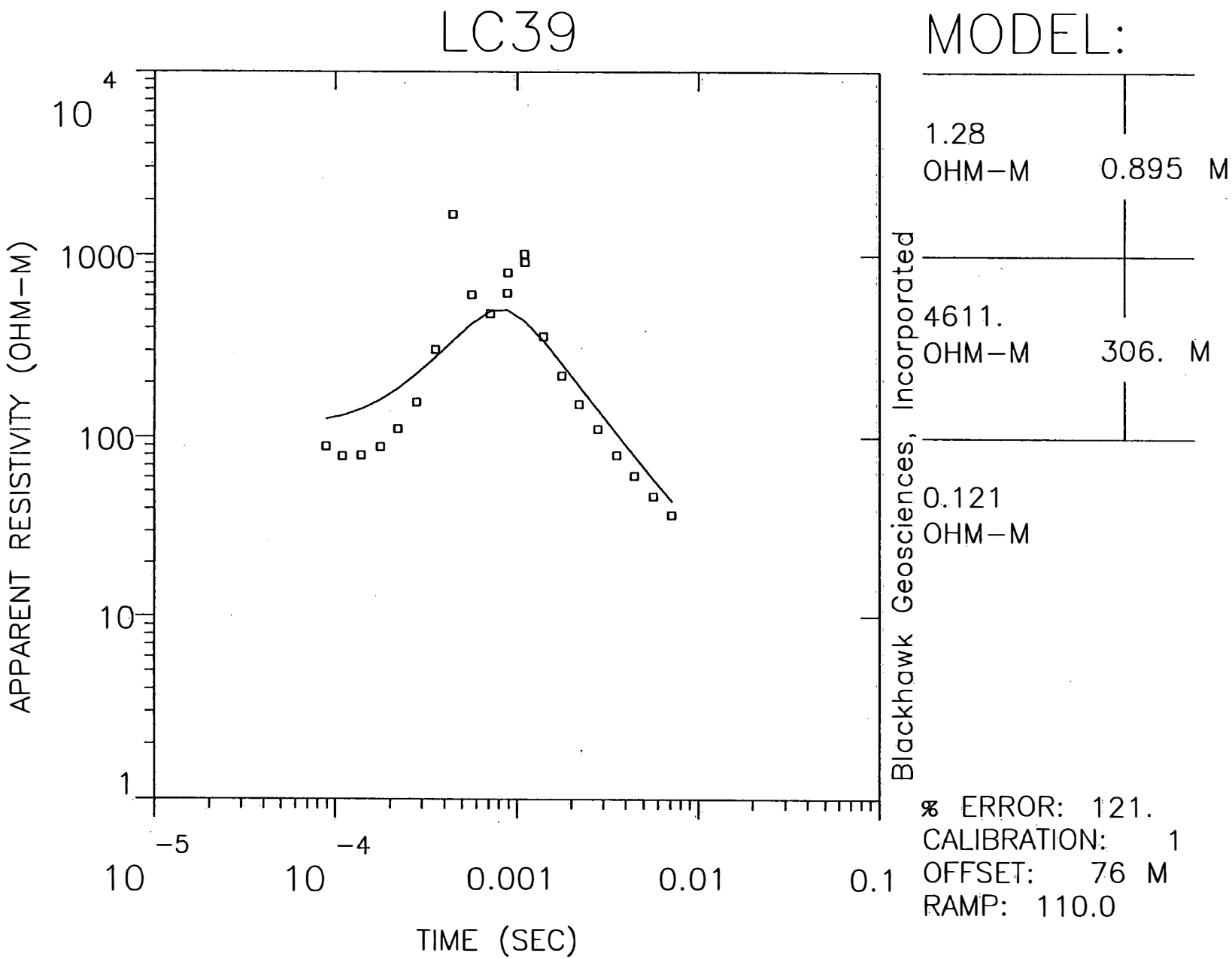
PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.77				
P 2	-0.09	0.07			
P 3	0.09	-0.03	0.84		
T 1	-0.25	-0.15	0.10	0.73	
T 2	-0.01	0.02	0.02	-0.01	1.00

P 1 P 2 P 3 T 1 T 2

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	27.193	35.461	48.527
	2	2406.972	3846.274	9428.679
	3	40.344	50.091	58.586
THICK	1	13.816	18.469	26.028
	2	503.746	518.199	536.643
DEPTH	1	13.816	18.469	26.028
	2	520.953	536.668	556.801



MODEL:

1.28 OHM-M — 0.895 M

4611. OHM-M — 306. M

0.121 OHM-M

% ERROR: 121.
CALIBRATION: 1
OFFSET: 76 M
RAMP: 110.0

LC39

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		288.0	945.0		
1.28	0.9	287.1	942.1	0.7	0.7
4610.60	305.6	-18.4	-60.4	0.1	0.8
0.12					

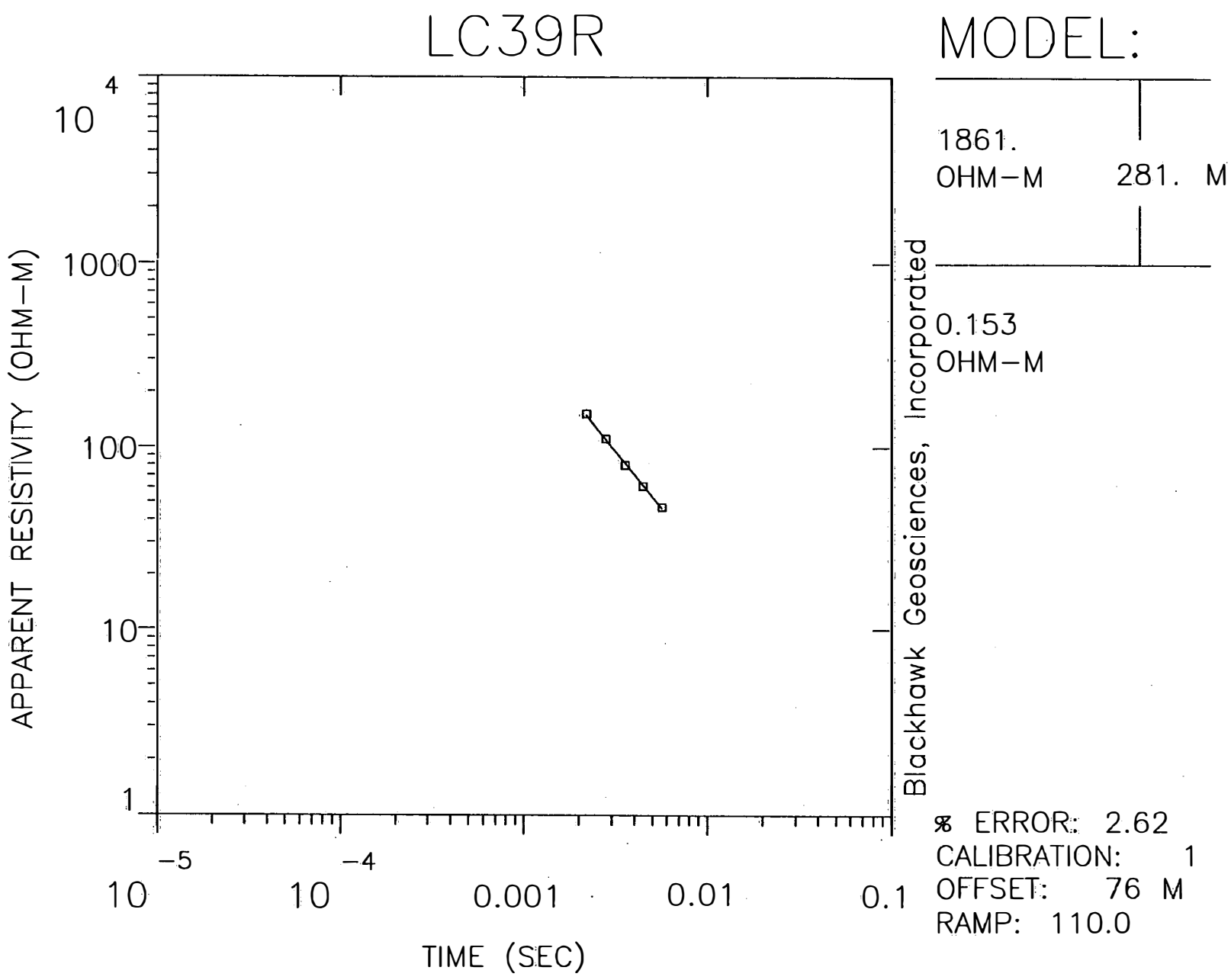
	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	8.78E+01	1.26E+02	-30.196	
2	1.10E-04	7.77E+01	1.32E+02	-40.968	
3	1.40E-04	7.95E+01	1.43E+02	-44.521	
4	1.77E-04	8.93E+01	1.61E+02	-44.444	
5	2.20E-04	1.11E+02	1.84E+02	-39.971	
6	2.80E-04	1.56E+02	2.22E+02	-29.937	
7	3.55E-04	3.04E+02	2.75E+02	10.442	
8	4.43E-04	1.69E+03	3.39E+02	397.145	
9	5.64E-04	6.14E+02	4.23E+02	45.185	
10	7.13E-04	4.78E+02	4.94E+02	-3.272	
11	8.81E-04	6.21E+02	5.01E+02	23.742	
12	8.90E-04	8.03E+02	5.00E+02	60.565	
13	1.10E-03	1.02E+03	4.36E+02	133.407	
14	1.10E-03	9.18E+02	4.35E+02	111.027	
15	1.40E-03	3.59E+02	3.38E+02	6.200	
16	1.77E-03	2.18E+02	2.54E+02	-14.158	
17	2.20E-03	1.51E+02	1.93E+02	-21.451	
18	2.80E-03	1.11E+02	1.42E+02	-21.991	
19	3.55E-03	7.95E+01	1.05E+02	-24.241	
20	4.43E-03	6.13E+01	7.96E+01	-23.008	
21	5.64E-03	4.69E+01	5.89E+01	-20.347	
22	7.13E-03	3.67E+01	4.41E+01	-16.748	

R: 76. X: 0. Y: 76. DL: 152. REQ: 84. CF: 1.0000
CLHZ ARRAY, 22 DATA POINTS, RAMP: 110.0 MICROSEC, DATA: LC39
1111 LC 3900NZ OPR XTL L 6 12+100
Ch.21 = 0.11 Ch.22 = 0.89 Ch.23 = 19 Ch.24 = 23
RMS LOG ERROR: 3.44E-01, ANTILOG YIELDS 120.7631 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2
P 1	0.49				
P 2	0.01	0.00			
P 3	0.00	0.00	0.02		
T 1	-0.47	-0.01	0.02	0.50	
T 2	-0.01	0.00	-0.11	-0.01	0.94


LC39R
MODEL:
1861.
OHM-M
281. M
0.153
OHM-M
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
Blackhawk Geosciences, Incorporated
% ERROR: 2.62
CALIBRATION: 1
OFFSET: 76 M
RAMP: 110.0

LC39R

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	(FEET)	CONDUCTANCE (S) LAYER	TOTAL
		288.0	945.0		
1860.88	281.5	6.5	21.5	0.2	0.2
0.15					

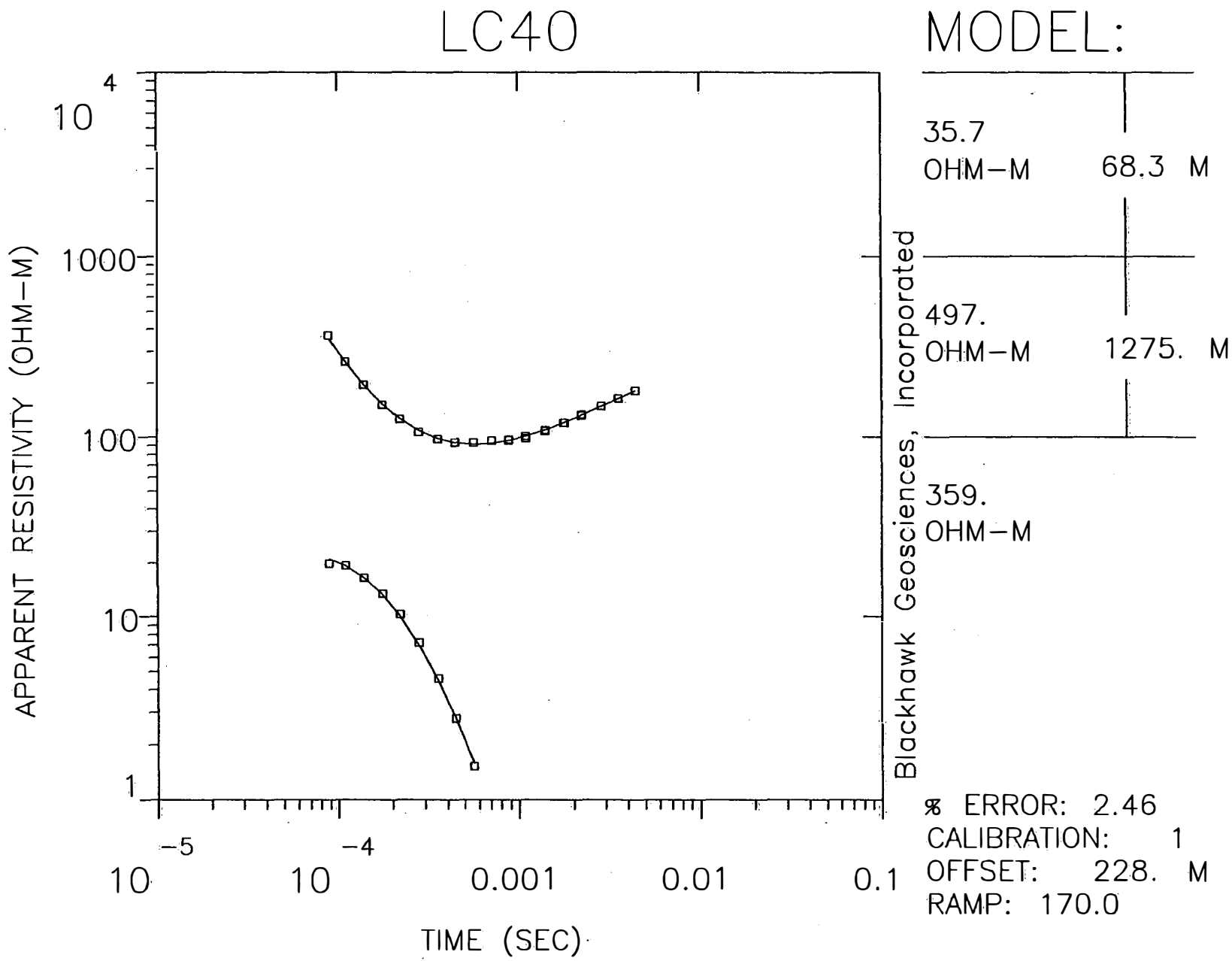
	TIMES	DATA	CALC	% ERROR	STD ERR
1	2.20E-03	1.51E+02	1.49E+02	1.391	
2	2.80E-03	1.11E+02	1.10E+02	0.619	
3	3.55E-03	7.95E+01	8.18E+01	-2.814	
4	4.43E-03	6.13E+01	6.21E+01	-1.236	
5	5.64E-03	4.69E+01	4.61E+01	1.708	

R: 76. X: 0. Y: 76. DL: 152. REQ: 84. CF: 1.0000
CLHZ ARRAY, 5 DATA POINTS, RAMP: 110.0 MICROSEC, DATA: LC39R
1111 LC 3900NZ OPR XTL L 6 12+100
Ch.21 = 0.11 Ch.22 = 0.89 Ch.23 = 19 Ch.24 = 23
RMS LOG ERROR: 1.12E-02, ANTILOG YIELDS 2.6189 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.00		
P 2	0.00	0.00	
T 1	0.00	-0.05	0.50
	P 1	P 2	T 1


LC40
MODEL:
APPARENT RESISTIVITY (OHM-M)
10 4
1000
100
10
1
10 -5
10 -4
0.001
0.01
0.1
TIME (SEC)
35.7
OHM-M
68.3 M
497.
OHM-M
1275. M
359.
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 2.46
CALIBRATION: 1
OFFSET: 228. M
RAMP: 170.0

LC40

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		485.9	1594.0		
35.66	68.3	417.6	1370.0	1.9	1.9
496.60	1274.7	-857.1	-2811.9	2.6	4.5
358.73					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	3.67E+02	3.52E+02	4.129	
2	1.10E-04	2.62E+02	2.63E+02	-0.285	
3	1.40E-04	1.95E+02	1.95E+02	0.031	
4	1.77E-04	1.51E+02	1.53E+02	-1.162	
5	2.20E-04	1.25E+02	1.27E+02	-1.454	
6	2.80E-04	1.06E+02	1.09E+02	-2.258	
7	3.55E-04	9.70E+01	9.82E+01	-1.239	
8	4.43E-04	9.32E+01	9.28E+01	0.424	
9	5.64E-04	9.31E+01	9.07E+01	2.633	
10	7.13E-04	9.54E+01	9.19E+01	3.799	
11	8.81E-04	9.60E+01	9.52E+01	0.788	
12	8.90E-04	9.62E+01	9.54E+01	0.748	
13	1.10E-03	1.01E+02	1.01E+02	0.062	
14	1.10E-03	9.84E+01	1.01E+02	-2.441	
15	1.40E-03	1.08E+02	1.09E+02	-1.389	
16	1.41E-03	1.09E+02	1.10E+02	-0.650	
17	1.77E-03	1.20E+02	1.20E+02	-0.194	
18	1.80E-03	1.19E+02	1.20E+02	-0.883	
19	2.20E-03	1.31E+02	1.31E+02	-0.365	
20	2.22E-03	1.33E+02	1.32E+02	0.818	
21	2.85E-03	1.49E+02	1.47E+02	0.838	
22	3.55E-03	1.64E+02	1.63E+02	0.612	
23	4.43E-03	1.81E+02	1.80E+02	0.573	

R: 228. X: 0. Y: 229. DL: 457. REQ: 254. CF: 1.0000
CLHZ ARRAY, 23 DATA POINTS, RAMP: 170.0 MICROSEC, DATA: LC40
1111 LC 4000NZ OPR XTL L 6 12+100
Ch.21 = 0.17 Ch.22 = 0.89 Ch.23 = 11 Ch.24 = 20
RMS LOG ERROR: 1.05E-02, ANTILOG YIELDS 2.4575 %
LATE TIME PARAMETERS

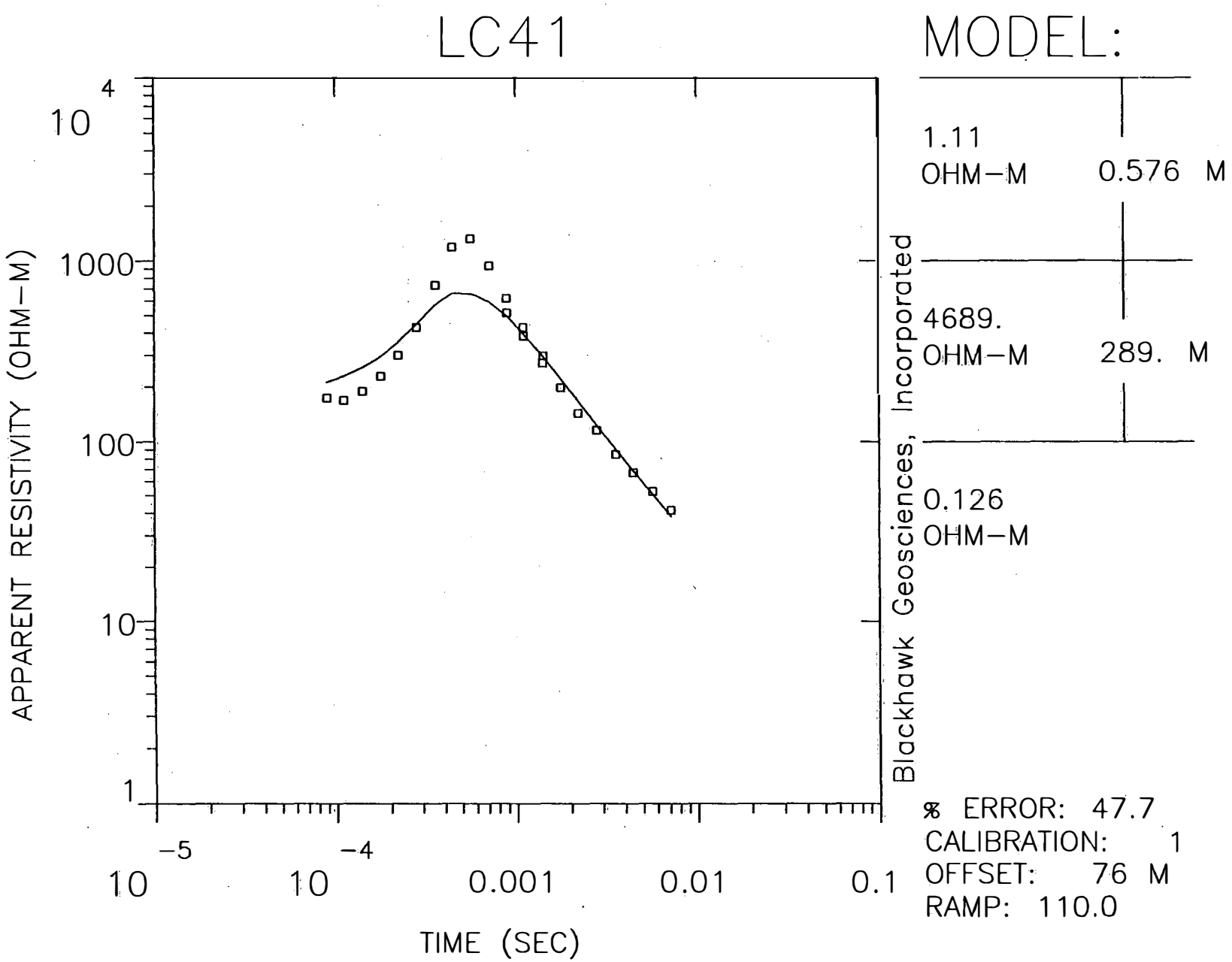
* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER
P 1 1.00
P 2 0.00 0.99
P 3 0.00 -0.02 0.14
T 1 0.00 0.00 0.00 1.00
T 2 0.00 0.05 0.22 0.01 0.46

P 1 P 2 P 3 T 1 T 2

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	33.468	35.660	39.122
	2	434.563	496.603	630.392
	3	223.096	358.733	3266.273
THICK	1	61.627	68.274	79.293
	2	318.722	1274.656	4028.082
DEPTH	1	61.627	68.274	79.293
	2	389.410	1342.930	4094.416


LC41
MODEL:
1.11
OHM-M
0.576 M
4689.
OHM-M
289. M
0.126
OHM-M
% ERROR: 47.7
CALIBRATION: 1
OFFSET: 76 M
RAMP: 110.0
Blackhawk Geosciences, Incorporated
APPARENT RESISTIVITY (OHM-M)
TIME (SEC)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1

LC41

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		320.0	1050.0		
1.11	0.6	319.5	1048.1	0.5	0.5
4688.83	288.6	30.9	101.3	0.1	0.6
0.13					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	1.73E+02	2.12E+02	-18.437	
2	1.10E-04	1.68E+02	2.29E+02	-26.404	
3	1.40E-04	1.90E+02	2.57E+02	-26.089	
4	1.77E-04	2.29E+02	2.98E+02	-23.208	
5	2.20E-04	2.99E+02	3.53E+02	-15.137	
6	2.80E-04	4.30E+02	4.45E+02	-3.429	
7	3.55E-04	7.31E+02	5.70E+02	28.267	
8	4.43E-04	1.19E+03	6.62E+02	80.199	
9	5.64E-04	1.33E+03	6.59E+02	101.494	
10	7.13E-04	9.39E+02	5.90E+02	59.198	
11	8.81E-04	6.19E+02	5.00E+02	23.945	
12	8.90E-04	5.16E+02	4.95E+02	4.299	
13	1.10E-03	4.29E+02	3.96E+02	8.419	
14	1.10E-03	3.84E+02	3.94E+02	-2.541	
15	1.40E-03	2.70E+02	2.95E+02	-8.279	
16	1.41E-03	2.96E+02	2.92E+02	1.505	
17	1.77E-03	1.97E+02	2.20E+02	-10.263	
18	2.20E-03	1.43E+02	1.67E+02	-14.279	
19	2.80E-03	1.15E+02	1.23E+02	-5.806	
20	3.55E-03	8.50E+01	9.09E+01	-6.468	
21	4.43E-03	6.72E+01	6.89E+01	-2.464	
22	5.64E-03	5.28E+01	5.10E+01	3.398	
23	7.13E-03	4.15E+01	3.82E+01	8.524	

R: 76. X: 0. Y: 76. DL: 152. REQ: 84. CF: 1.0000
CLHZ ARRAY, 23 DATA POINTS, RAMP: 110.0 MICROSEC, DATA: LC41
1211 LC 4100NZ OPR XTL L 7 12+100
Ch.21 = 0.11 Ch.22 = 0.89 Ch.23 = 18.5 Ch.24 =
RMS LOG ERROR: 1.69E-01, ANTILOG YIELDS 47.7073 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

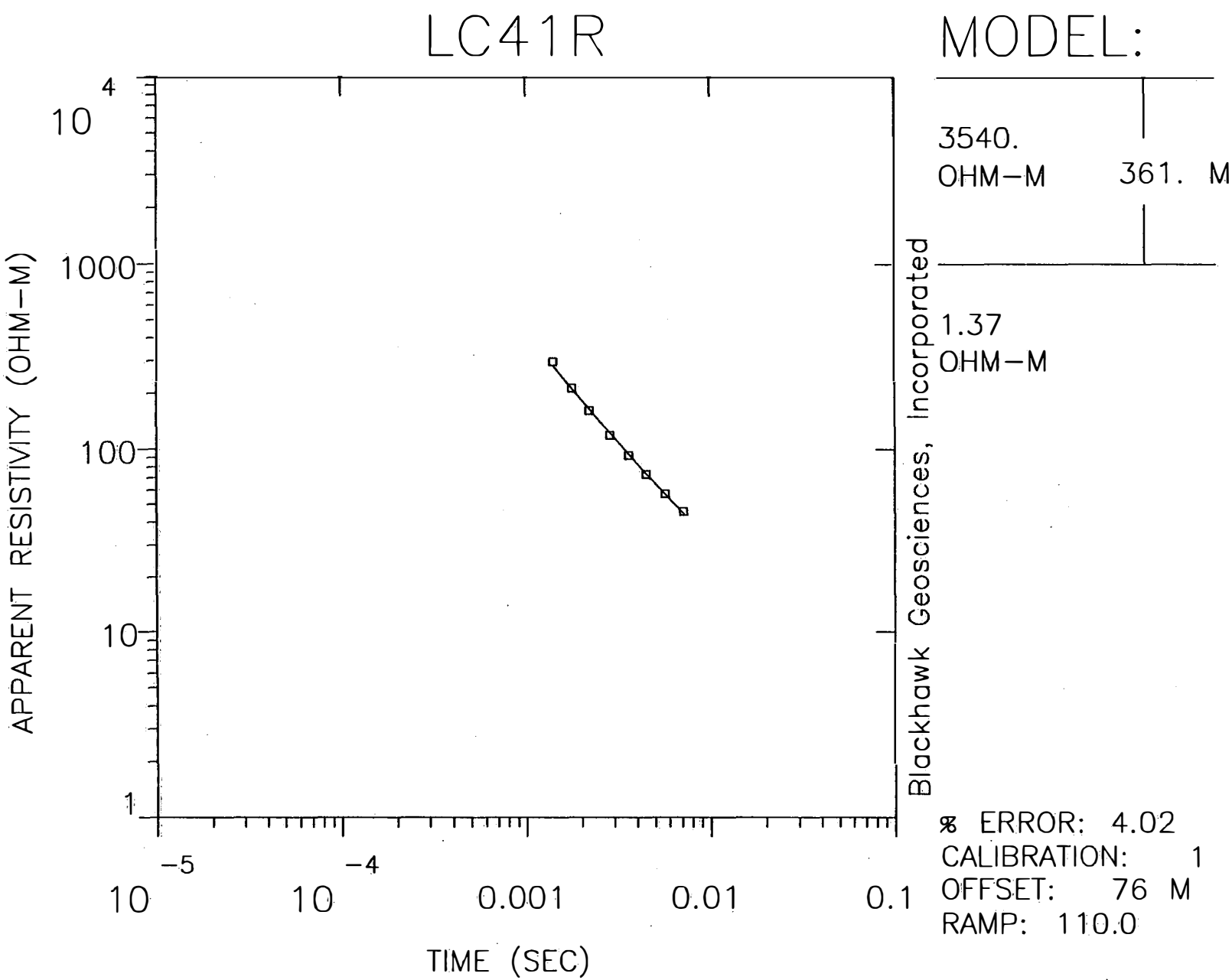
PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.59				
P 2	0.00	0.02			
P 3	0.08	-0.02	0.15		
T 1	-0.40	-0.03	0.10	0.59	
T 2	0.00	0.00	-0.09	0.00	0.99

P 1 P 2 P 3 T 1 T 2

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	0.188	1.115	21.184
	2	918.062	4688.835	46888.352
	3	0.000	0.126	0.665
THICK	1	0.097	0.576	10.656
	2	95.911	288.593	359.730
DEPTH	1	0.097	0.576	10.656
	2	96.727	289.168	360.267


LC41R
MODEL:
3540.
OHM-M
361. M
1.37
OHM-M
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
Blackhawk Geosciences, Incorporated
% ERROR: 4.02
CALIBRATION: 1
OFFSET: 76 M
RAMP: 110.0

LC41R

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		320.0	1050.0		
3539.96	360.6	-40.5	-133.0	0.1	0.1
1.37					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	1.41E-03	2.96E+02	2.82E+02	4.940	
2	1.80E-03	2.12E+02	2.11E+02	0.451	
3	2.22E-03	1.61E+02	1.64E+02	-1.866	
4	2.85E-03	1.19E+02	1.23E+02	-3.569	
5	3.60E-03	9.22E+01	9.44E+01	-2.291	
6	4.49E-03	7.32E+01	7.38E+01	-0.886	
7	5.70E-03	5.73E+01	5.70E+01	0.540	
8	7.19E-03	4.59E+01	4.46E+01	2.967	

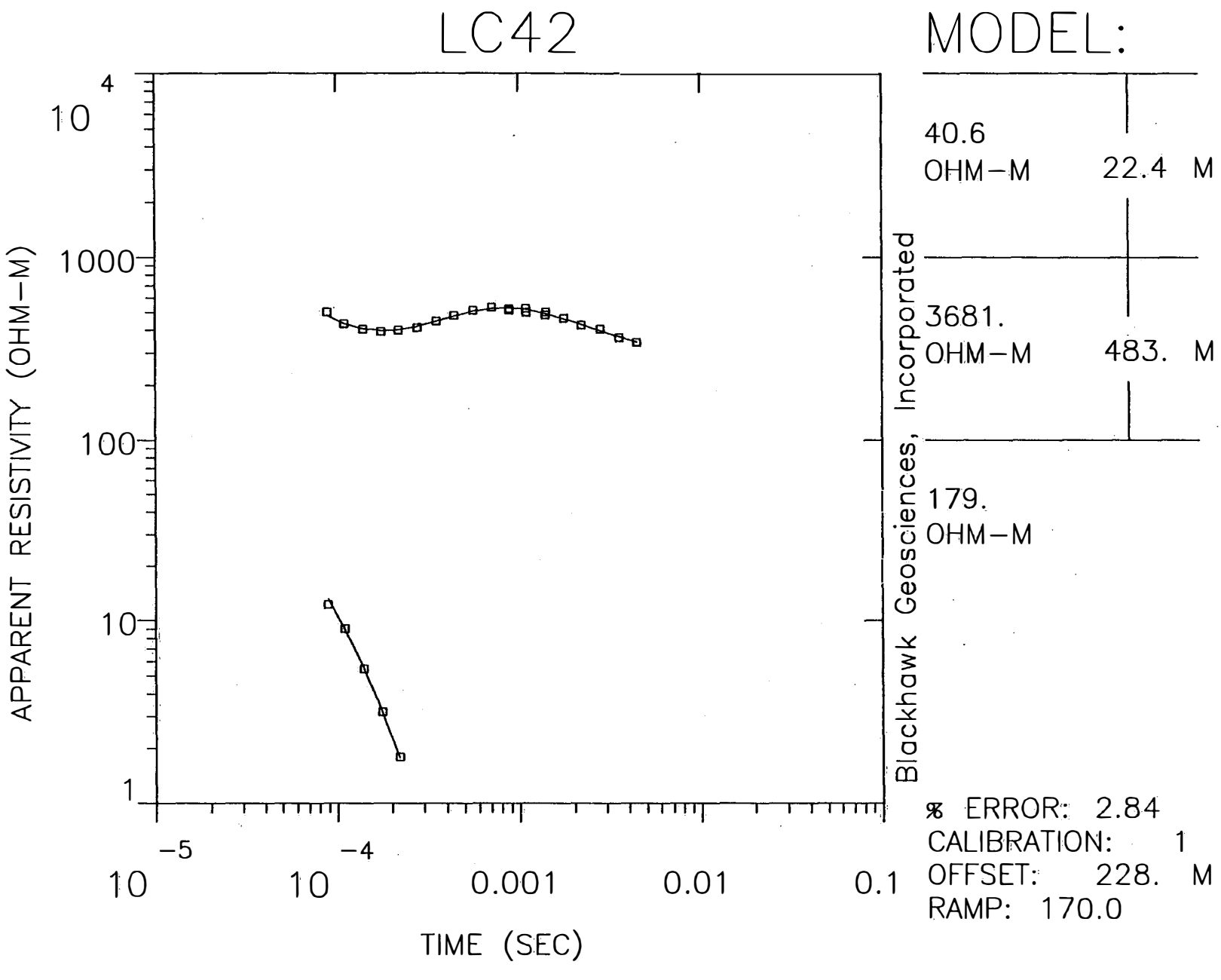
R: 76. X: 0. Y: 76. DL: 152. REQ: 84. CF: 1.0000
CLHZ ARRAY, 8 DATA POINTS, RAMP: 110.0 MICROSEC, DATA: LC41R
1211 LC 4100NZ OPR XTL H 4 8 +100
Ch.21 = 0.11 Ch.22 = 0.089 Ch.23 = 18.5 Ch.24 =
RMS LOG ERROR: 1.71E-02, ANTILOG YIELDS 4.0190 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER
P 1 0.01
P 2 -0.03 0.98
T 1 0.00 0.00 1.00
P 1 P 2 T 1

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	575.702	3539.960	35399.602
	2	0.932	1.374	1.858
THICK	1	351.595	360.570	367.701
DEPTH	1	351.595	360.570	367.701


LC42
MODEL:
40.6
OHM-M
22.4 M
3681.
OHM-M
483. M
179.
OHM-M
% ERROR: 2.84
CALIBRATION: 1
OFFSET: 228. M
RAMP: 170.0
Blackhawk Geosciences, Incorporated
APPARENT RESISTIVITY (OHM-M)
TIME (SEC)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1

LC42

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		700.1	2297.0		
40.65	22.4	677.7	2223.4	0.6	0.6
3680.52	483.1	194.6	638.4	0.1	0.7
178.95					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	8.90E-05	5.04E+02	4.82E+02	4.524	
2	1.10E-04	4.33E+02	4.35E+02	-0.492	
3	1.40E-04	4.06E+02	4.07E+02	-0.257	
4	1.77E-04	3.93E+02	3.98E+02	-1.319	
5	2.20E-04	4.01E+02	4.03E+02	-0.536	
6	2.80E-04	4.15E+02	4.21E+02	-1.417	
7	3.55E-04	4.48E+02	4.47E+02	0.175	
8	4.43E-04	4.81E+02	4.77E+02	0.894	
9	5.64E-04	5.14E+02	5.08E+02	1.138	
10	7.13E-04	5.36E+02	5.28E+02	1.497	
11	8.81E-04	5.25E+02	5.31E+02	-1.265	
12	8.90E-04	5.17E+02	5.31E+02	-2.734	
13	1.10E-03	5.27E+02	5.20E+02	1.343	
14	1.10E-03	4.99E+02	5.20E+02	-4.000	
15	1.40E-03	4.84E+02	4.93E+02	-1.905	
16	1.41E-03	5.03E+02	4.92E+02	2.143	
17	1.77E-03	4.64E+02	4.61E+02	0.737	
18	2.20E-03	4.26E+02	4.30E+02	-0.931	
19	2.80E-03	4.06E+02	3.97E+02	2.331	
20	3.55E-03	3.64E+02	3.69E+02	-1.258	
21	4.43E-03	3.43E+02	3.45E+02	-0.650	

R: 228. X: 0. Y: 229. DL: 457. REQ: 254. CF: 1.0000
CLHZ ARRAY, 21 DATA POINTS, RAMP: 170.0 MICROSEC, DATA: LC42
1211 LC 4200NZ OPR XTL L 6 12+100
Ch.21 = 0.17 Ch.22 = 0.89 Ch.23 = 11 Ch.24 = 20
RMS LOG ERROR: 1.21E-02, ANTILOG YIELDS 2.8357 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

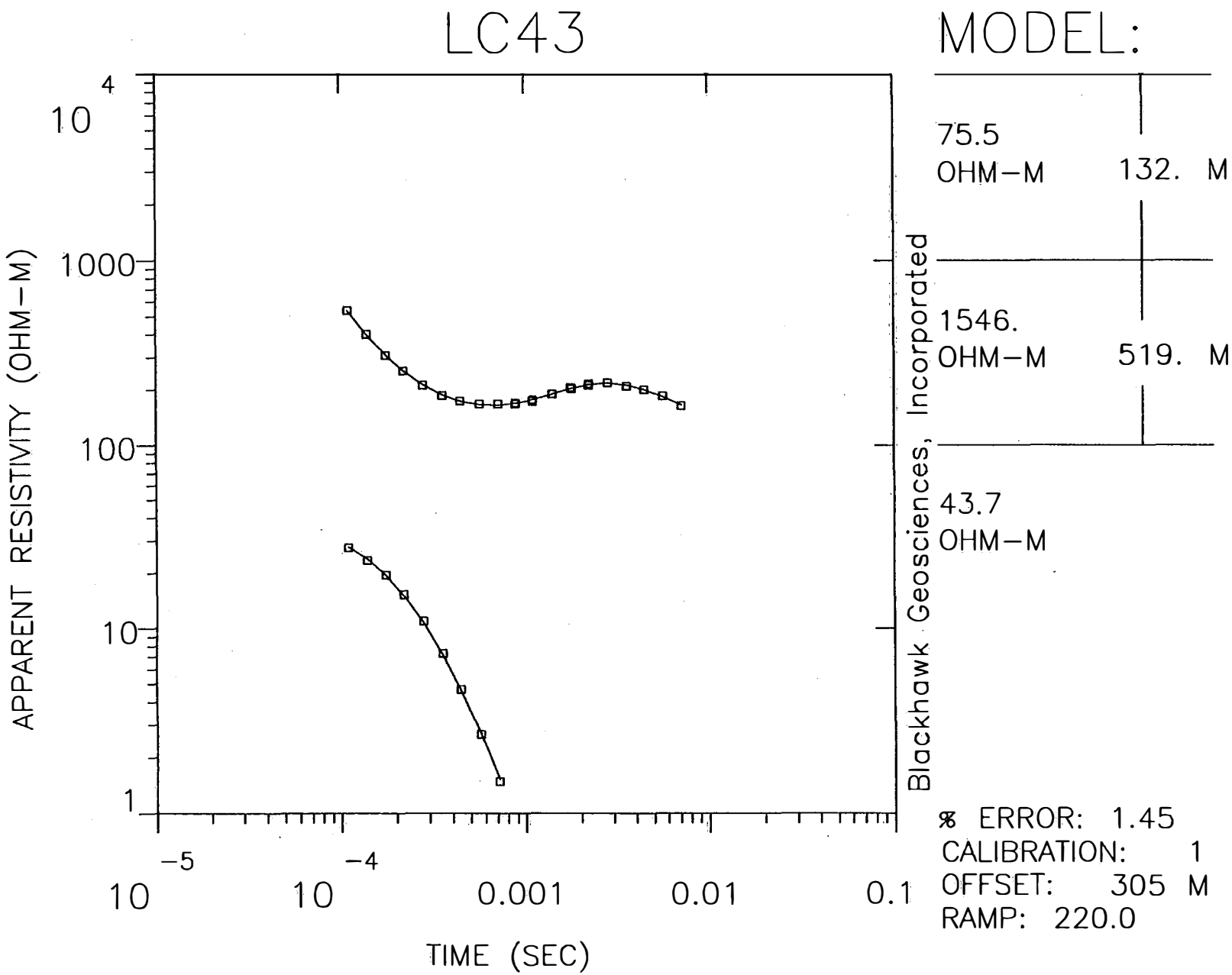
PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2
P 1	0.80				
P 2	-0.08	0.05			
P 3	0.08	-0.03	0.87		
T 1	-0.22	-0.13	0.09	0.75	
T 2	-0.04	0.06	0.06	-0.05	0.97

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

LAYER	MINIMUM	BEST	MAXIMUM

RHO	1	32.657	40.646	46.569
	2	2332.505	3680.523	7688.081
	3	162.712	178.946	207.252
THICK	1	17.591	22.432	26.091
	2	446.103	483.108	507.584
DEPTH	1	17.591	22.432	26.091
	2	466.200	505.540	531.599


LC43
MODEL:
75.5
OHM-M
132. M
1546.
OHM-M
519. M
43.7
OHM-M
% ERROR: 1.45
CALIBRATION: 1
OFFSET: 305 M
RAMP: 220.0
Blackhawk Geosciences, Incorporated
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)

LC43

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		609.0	1998.0		
75.48	131.8	477.2	1565.6	1.7	1.7
1545.99	519.5	-42.3	-138.8	0.3	2.1
43.75					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	1.10E-04	5.40E+02	5.37E+02	0.537	
2	1.40E-04	4.02E+02	3.98E+02	0.990	
3	1.77E-04	3.08E+02	3.09E+02	-0.289	
4	2.20E-04	2.52E+02	2.54E+02	-0.486	
5	2.80E-04	2.11E+02	2.13E+02	-0.973	
6	3.55E-04	1.86E+02	1.88E+02	-0.844	
7	4.43E-04	1.74E+02	1.74E+02	0.003	
8	5.64E-04	1.68E+02	1.66E+02	1.268	
9	7.13E-04	1.68E+02	1.65E+02	1.894	
10	8.81E-04	1.67E+02	1.69E+02	-0.695	
11	8.90E-04	1.70E+02	1.69E+02	0.492	
12	1.10E-03	1.76E+02	1.77E+02	-0.509	
13	1.10E-03	1.73E+02	1.77E+02	-1.960	
14	1.40E-03	1.90E+02	1.89E+02	0.171	
15	1.41E-03	1.89E+02	1.90E+02	-0.095	
16	1.77E-03	2.05E+02	2.03E+02	1.023	
17	1.80E-03	2.03E+02	2.04E+02	-0.106	
18	2.20E-03	2.12E+02	2.13E+02	-0.636	
19	2.22E-03	2.16E+02	2.14E+02	1.227	
20	2.80E-03	2.19E+02	2.18E+02	0.388	
21	3.55E-03	2.09E+02	2.13E+02	-1.742	
22	4.43E-03	2.01E+02	2.00E+02	0.211	
23	5.64E-03	1.85E+02	1.83E+02	1.467	
24	7.13E-03	1.64E+02	1.65E+02	-0.759	

R: 305. X: 0. Y: 305. DL: 610. REQ: 339. CF: 1.0000
CLHZ ARRAY, 24 DATA POINTS, RAMP: 220.0 MICROSEC, DATA: LC43
1311 LC 4300NZ OPR XTL L 6 12+100
Ch.21 = 0.22 Ch.22 = 0.89 Ch.23 = 11 Ch.24 = 37
RMS LOG ERROR: 6.27E-03, ANTILOG YIELDS 1.4541 %
LATE TIME PARAMETERS

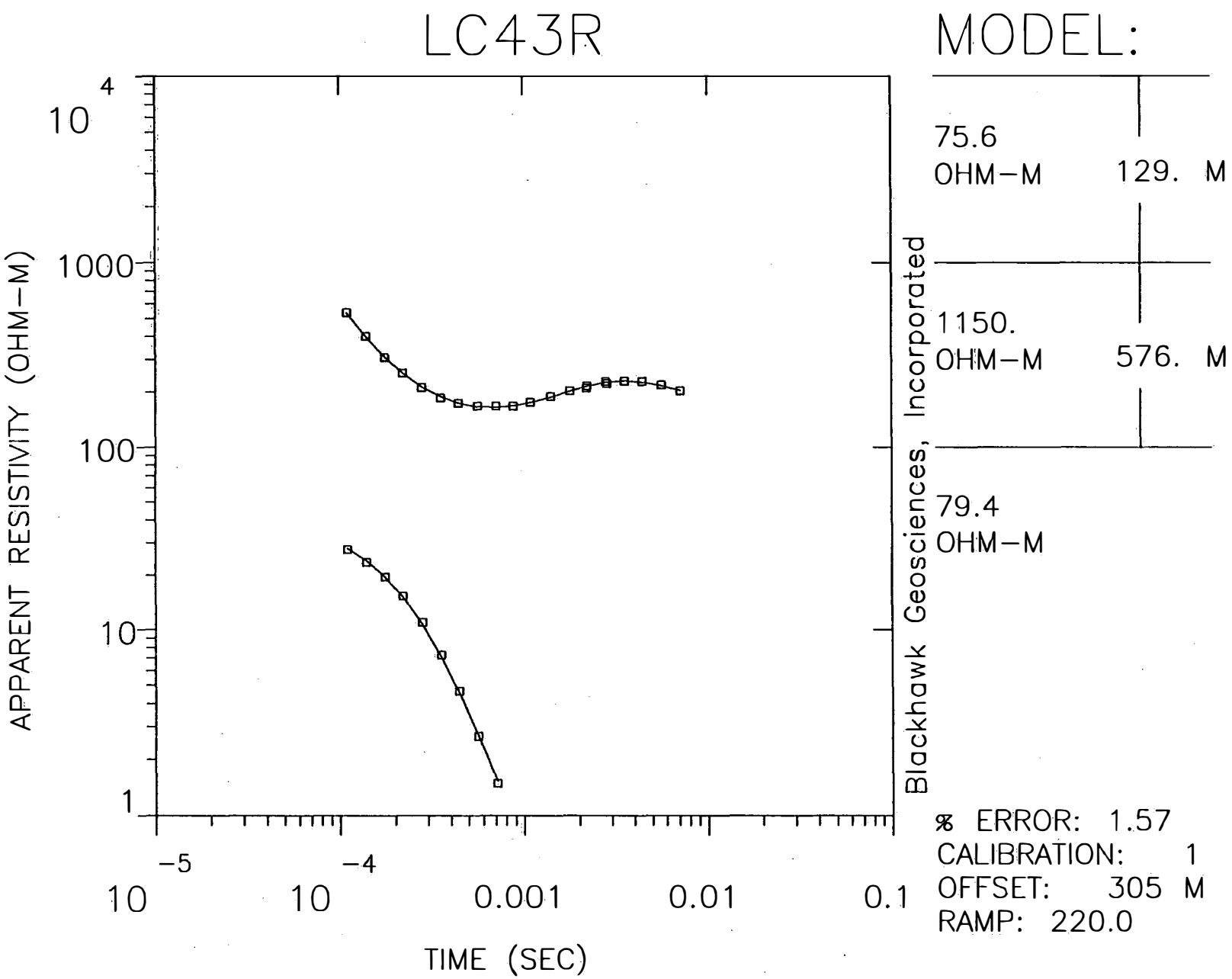
* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER
P 1 1.00
P 2 -0.01 0.38
P 3 0.00 -0.07 0.97
T 1 0.00 -0.04 0.00 1.00

```
T 2  0.00  0.04  0.01  0.00  1.00
       P 1   P 2   P 3   T 1   T 2
```

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	73.722	75.476	77.698
	2	992.401	1545.987	2640.082
	3	36.654	43.749	52.263
THICK	1	124.808	131.805	140.984
	2	494.672	519.487	545.416
DEPTH	1	124.808	131.805	140.984
	2	628.294	651.292	675.438


LC43R
MODEL:
APPARENT RESISTIVITY (OHM-M)
10 4
1000
100
10
1
10 -5
10 -4
0.001
0.01
0.1
TIME (SEC)
75.6
OHM-M
129. M
1150.
OHM-M
576. M
79.4
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 1.57
CALIBRATION: 1
OFFSET: 305 M
RAMP: 220.0

LC43R

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		609.0	1998.0		
75.58	128.8	480.2	1575.4	1.7	1.7
1149.70	576.4	-96.2	-315.5	0.5	2.2
79.36					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	1.10E-04	5.40E+02	5.36E+02	0.692	
2	1.40E-04	4.02E+02	3.98E+02	1.031	
3	1.77E-04	3.08E+02	3.09E+02	-0.384	
4	2.20E-04	2.52E+02	2.54E+02	-0.707	
5	2.80E-04	2.11E+02	2.14E+02	-1.305	
6	3.55E-04	1.86E+02	1.88E+02	-1.230	
7	4.43E-04	1.74E+02	1.74E+02	-0.364	
8	5.64E-04	1.68E+02	1.66E+02	1.031	
9	7.13E-04	1.68E+02	1.65E+02	1.910	
10	8.81E-04	1.67E+02	1.68E+02	-0.367	
11	1.10E-03	1.76E+02	1.75E+02	0.167	
12	1.41E-03	1.89E+02	1.88E+02	0.799	
13	1.80E-03	2.03E+02	2.03E+02	0.392	
14	2.20E-03	2.10E+02	2.15E+02	-1.978	
15	2.22E-03	2.16E+02	2.15E+02	0.428	
16	2.80E-03	2.28E+02	2.25E+02	1.066	
17	2.85E-03	2.22E+02	2.26E+02	-1.877	
18	3.55E-03	2.29E+02	2.29E+02	-0.233	
19	4.43E-03	2.29E+02	2.26E+02	1.146	
20	5.64E-03	2.18E+02	2.16E+02	0.944	
21	7.13E-03	2.02E+02	2.04E+02	-0.698	

R: 305. X: 0. Y: 305. DL: 610. REQ: 339. CF: 1.0000
CLHZ ARRAY, 21 DATA POINTS, RAMP: 220.0 MICROSEC, DATA: LC43R
1311 LC 4300NZ OPR XTL L 6 12+1000
Ch.21 = 0.22 Ch.22 = 0.89 Ch.23 = 11 Ch.24 = 37
RMS LOG ERROR: 6.78E-03, ANTILOG YIELDS 1.5741 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

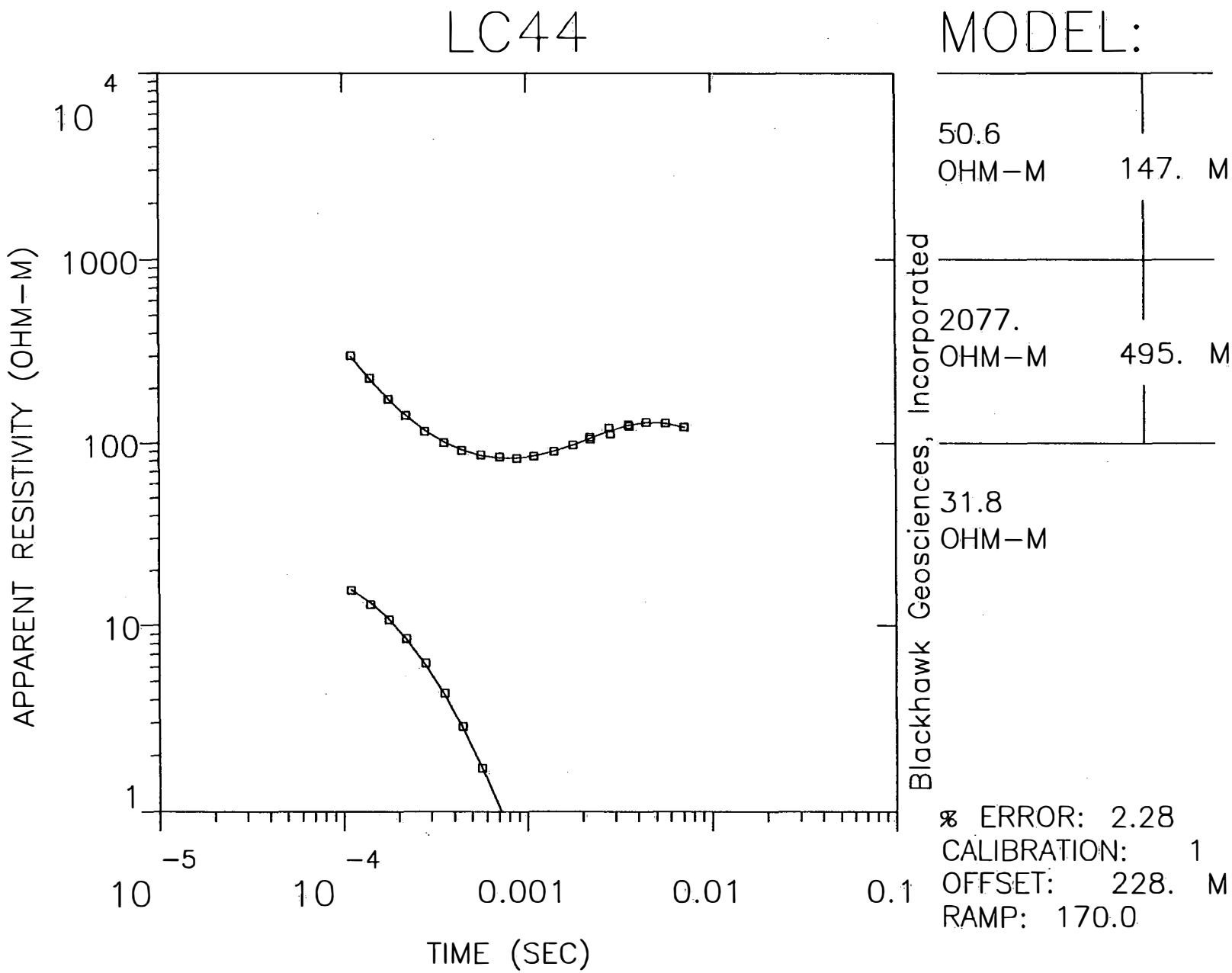
PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2
P 1	0.99				
P 2	-0.02	0.08			
P 3	0.02	-0.10	0.50		
T 1	-0.02	-0.10	0.04	0.96	
T 2	0.00	0.11	0.13	0.00	0.95

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

LAYER	MINIMUM	BEST	MAXIMUM

RHO	1	72.108	75.576	78.072
	2	847.970	1149.702	1815.763
	3	63.497	79.358	106.744
THICK	1	118.261	128.806	136.816
	2	512.783	576.358	620.318
DEPTH	1	118.261	128.806	136.816
	2	640.470	705.164	749.832


LC44
MODEL:
APPARENT RESISTIVITY (OHM-M)
10 4
1000
100
10
1
10 -5
10 -4
0.001
0.01
0.1
TIME (SEC)
50.6
OHM-M
147. M
2077.
OHM-M
495. M
31.8
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 2.28
CALIBRATION: 1
OFFSET: 228. M
RAMP: 170.0

LC44

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		487.1	1598.0		
50.65	146.9	340.1	1115.9	2.9	2.9
2076.56	494.7	-154.5	-506.9	0.2	3.1
31.77					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	1.10E-04	3.02E+02	3.00E+02	0.811	
2	1.40E-04	2.28E+02	2.25E+02	1.338	
3	1.77E-04	1.75E+02	1.75E+02	0.093	
4	2.20E-04	1.42E+02	1.42E+02	-0.257	
5	2.80E-04	1.16E+02	1.18E+02	-1.283	
6	3.55E-04	1.01E+02	1.02E+02	-1.112	
7	4.43E-04	9.15E+01	9.19E+01	-0.479	
8	5.64E-04	8.64E+01	8.56E+01	0.912	
9	7.13E-04	8.42E+01	8.29E+01	1.639	
10	8.81E-04	8.24E+01	8.28E+01	-0.470	
11	1.10E-03	8.49E+01	8.51E+01	-0.215	
12	1.41E-03	9.03E+01	9.04E+01	-0.107	
13	1.80E-03	9.75E+01	9.80E+01	-0.518	
14	2.20E-03	1.08E+02	1.06E+02	1.369	
15	2.22E-03	1.05E+02	1.07E+02	-1.202	
16	2.80E-03	1.21E+02	1.16E+02	4.151	
17	2.85E-03	1.12E+02	1.17E+02	-4.106	
18	3.55E-03	1.27E+02	1.25E+02	1.183	
19	3.60E-03	1.24E+02	1.25E+02	-0.949	
20	4.43E-03	1.30E+02	1.29E+02	0.424	
21	5.64E-03	1.28E+02	1.29E+02	-0.074	
22	7.13E-03	1.23E+02	1.22E+02	0.061	

R: 228. X: 0. Y: 229. DL: 457. REQ: 254. CF: 1.0000
CLHZ ARRAY, 22 DATA POINTS, RAMP: 170.0 MICROSEC, DATA: LC44
1311 LC 4400NZ OPR XTL L 5 12+1000
Ch.21 = 0.17 Ch.22 = 0.89 Ch.23 = 11 Ch.24 = 20
RMS LOG ERROR: 9.78E-03, ANTILOG YIELDS 2.2771 %
LATE TIME PARAMETERS

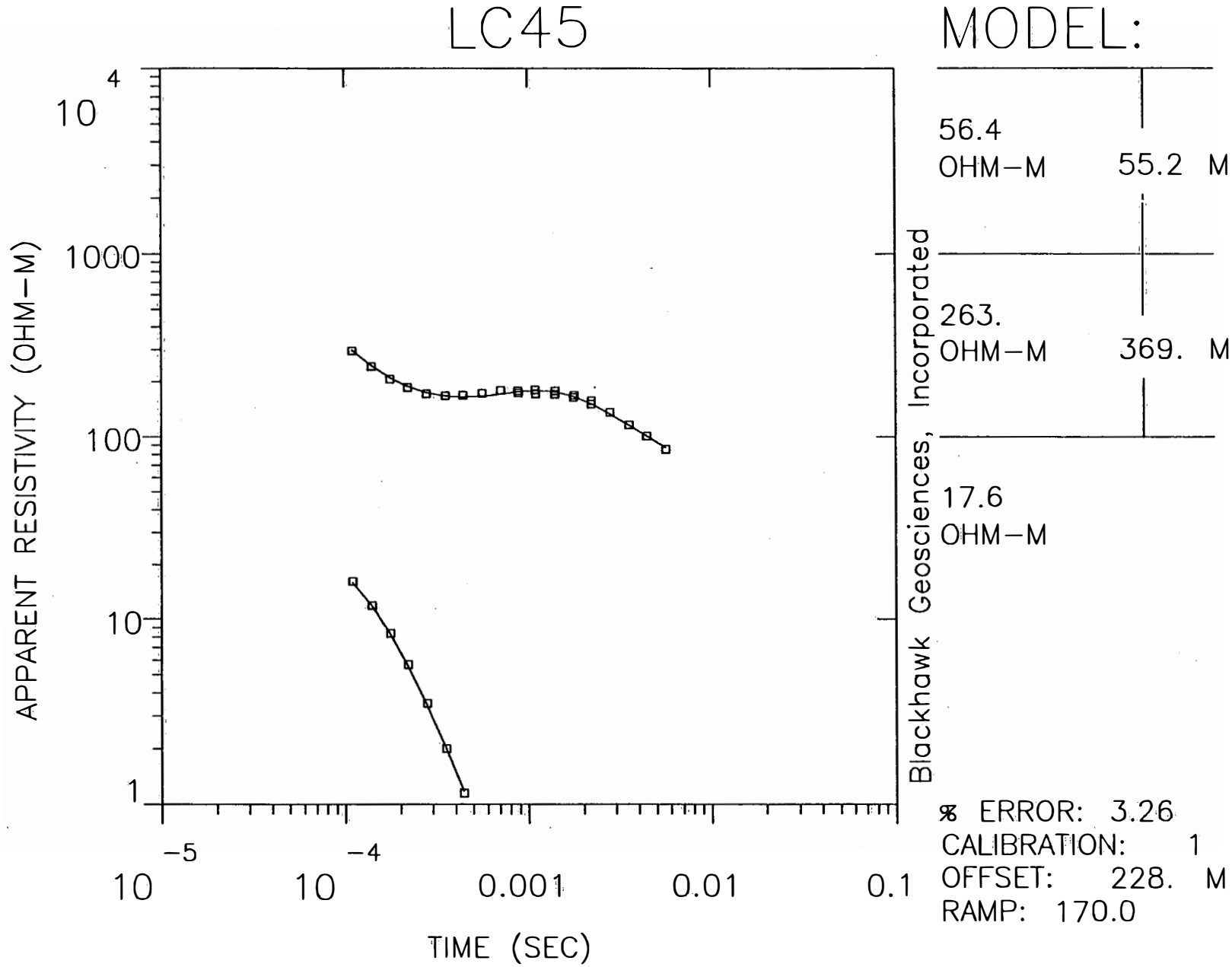
* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	1.00				
P 2	0.00	0.08			
P 3	0.00	-0.10	0.91		
T 1	0.00	-0.02	0.00	1.00	
T 2	0.00	0.03	0.01	0.00	1.00
	P 1	P 2	P 3	T 1	T 2

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	48.909	50.647	52.319
	2	882.970	2076.557	7774.970
	3	17.287	31.770	51.846
THICK	1	137.747	146.933	156.032
	2	447.364	494.652	539.390
DEPTH	1	137.747	146.933	156.032
	2	595.204	641.585	688.192


LC45
MODEL:
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
56.4
OHM-M
55.2 M
263.
OHM-M
369. M
17.6
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 3.26
CALIBRATION: 1
OFFSET: 228. M
RAMP: 170.0

LC45

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		462.1	1516.0		
56.45	55.2	406.9	1334.9	1.0	1.0
263.19	369.3	37.5	123.2	1.4	2.4
17.58					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	1.10E-04	2.95E+02	2.98E+02	-1.032	
2	1.40E-04	2.43E+02	2.44E+02	-0.576	
3	1.77E-04	2.06E+02	2.10E+02	-1.495	
4	2.20E-04	1.86E+02	1.89E+02	-1.256	
5	2.80E-04	1.72E+02	1.74E+02	-1.476	
6	3.55E-04	1.68E+02	1.67E+02	0.200	
7	4.43E-04	1.68E+02	1.65E+02	1.782	
8	5.64E-04	1.73E+02	1.67E+02	3.556	
9	7.13E-04	1.79E+02	1.72E+02	4.403	
10	8.81E-04	1.78E+02	1.76E+02	1.057	
11	8.90E-04	1.74E+02	1.77E+02	-1.631	
12	1.10E-03	1.81E+02	1.79E+02	0.896	
13	1.10E-03	1.71E+02	1.79E+02	-4.278	
14	1.40E-03	1.71E+02	1.76E+02	-2.960	
15	1.41E-03	1.78E+02	1.76E+02	1.264	
16	1.77E-03	1.65E+02	1.66E+02	-1.025	
17	1.80E-03	1.69E+02	1.65E+02	2.134	
18	2.20E-03	1.51E+02	1.52E+02	-0.315	
19	2.22E-03	1.58E+02	1.51E+02	4.302	
20	2.80E-03	1.36E+02	1.33E+02	1.815	
21	3.55E-03	1.16E+02	1.16E+02	-0.020	
22	4.43E-03	1.01E+02	1.01E+02	0.103	
23	5.64E-03	8.55E+01	8.70E+01	-1.737	

R: 228. X: 0. Y: 229. DL: 457. REQ: 254. CF: 1.0000
CLHZ ARRAY, 23 DATA POINTS, RAMP: 170.0 MICROSEC, DATA: LC45
1411 LC 4500NZ OPR XTL L 5 12+100
Ch.21 = 0.17 Ch.22 = 0.89 Ch.23 = 11 Ch.24 = 20
RMS LOG ERROR: 1.39E-02, ANTILOG YIELDS 3.2636 %
LATE TIME PARAMETERS

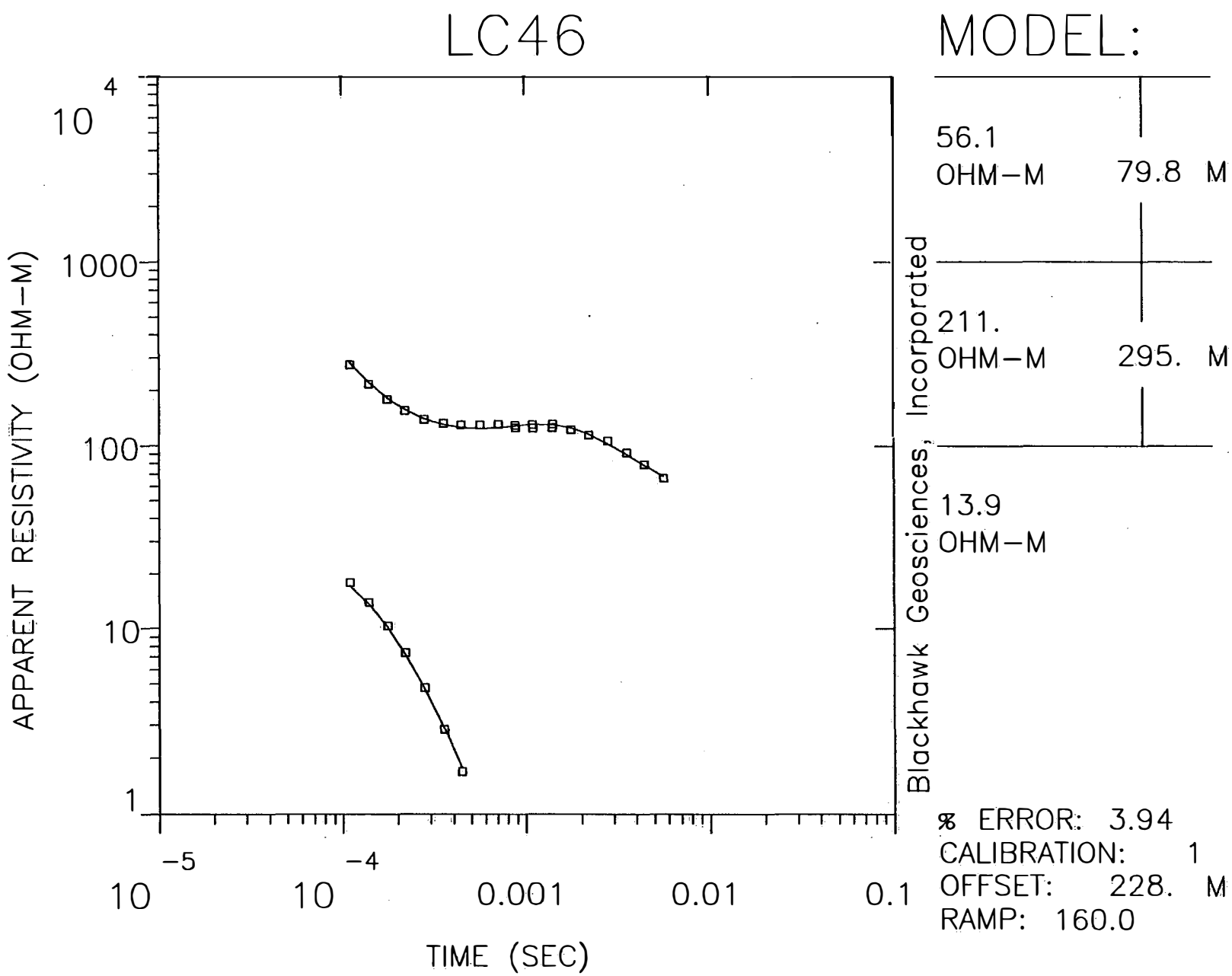
* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.93				
P 2	-0.11	0.64			
P 3	0.00	-0.11	0.78		
T 1	-0.15	-0.32	-0.03	0.63	
T 2	0.03	0.09	0.03	0.08	0.98
	P 1	P 2	P 3	T 1	T 2

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	53.438	56.450	63.616
	2	230.138	263.193	368.232
	3	15.084	17.577	23.867
THICK	1	48.644	55.202	75.750
	2	336.744	369.335	383.225
DEPTH	1	48.644	55.202	75.750
	2	410.973	424.537	431.869


LC46
MODEL:
APPARENT RESISTIVITY (OHM-M)
10 4
1000
100
10
1
10 -5
10 -4
0.001
0.01
0.1
TIME (SEC)
56.1
OHM-M
79.8 M
211.
OHM-M
295. M
13.9
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 3.94
CALIBRATION: 1
OFFSET: 228. M
RAMP: 160.0

LC46

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	(FEET)	CONDUCTANCE (S) LAYER	TOTAL
		465.1	1526.0		
56.06	79.8	385.3	1264.0	1.4	1.4
211.21	295.3	90.0	295.4	1.4	2.8
13.90					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	1.10E-04	2.75E+02	2.83E+02	-2.685	
2	1.40E-04	2.17E+02	2.22E+02	-1.927	
3	1.77E-04	1.79E+02	1.83E+02	-1.915	
4	2.20E-04	1.56E+02	1.58E+02	-1.369	
5	2.80E-04	1.40E+02	1.41E+02	-0.664	
6	3.55E-04	1.33E+02	1.30E+02	1.568	
7	4.43E-04	1.30E+02	1.26E+02	3.386	
8	5.64E-04	1.30E+02	1.24E+02	4.699	
9	7.13E-04	1.31E+02	1.26E+02	4.356	
10	8.81E-04	1.29E+02	1.29E+02	0.530	
11	8.90E-04	1.26E+02	1.29E+02	-2.211	
12	1.10E-03	1.30E+02	1.31E+02	-0.564	
13	1.10E-03	1.25E+02	1.31E+02	-4.803	
14	1.40E-03	1.26E+02	1.30E+02	-3.731	
15	1.41E-03	1.31E+02	1.30E+02	0.331	
16	1.77E-03	1.22E+02	1.25E+02	-1.979	
17	2.20E-03	1.15E+02	1.16E+02	-0.729	
18	2.80E-03	1.06E+02	1.03E+02	3.519	
19	3.55E-03	9.16E+01	8.97E+01	2.084	
20	4.43E-03	7.91E+01	7.85E+01	0.743	
21	5.64E-03	6.67E+01	6.80E+01	-1.799	

R: 228. X: 0. Y: 229. DL: 457. REQ: 254. CF: 1.0000
CLHZ ARRAY, 21 DATA POINTS, RAMP: 160.0 MICROSEC, DATA: LC46
1411 LC 4600NZ OPR XTL L 5 12+100
Ch.21 = 0.16 Ch.22 = 0.89 Ch.23 = 11 Ch.24 = 20
RMS LOG ERROR: 1.68E-02, ANTILOG YIELDS 3.9351 %
LATE TIME PARAMETERS

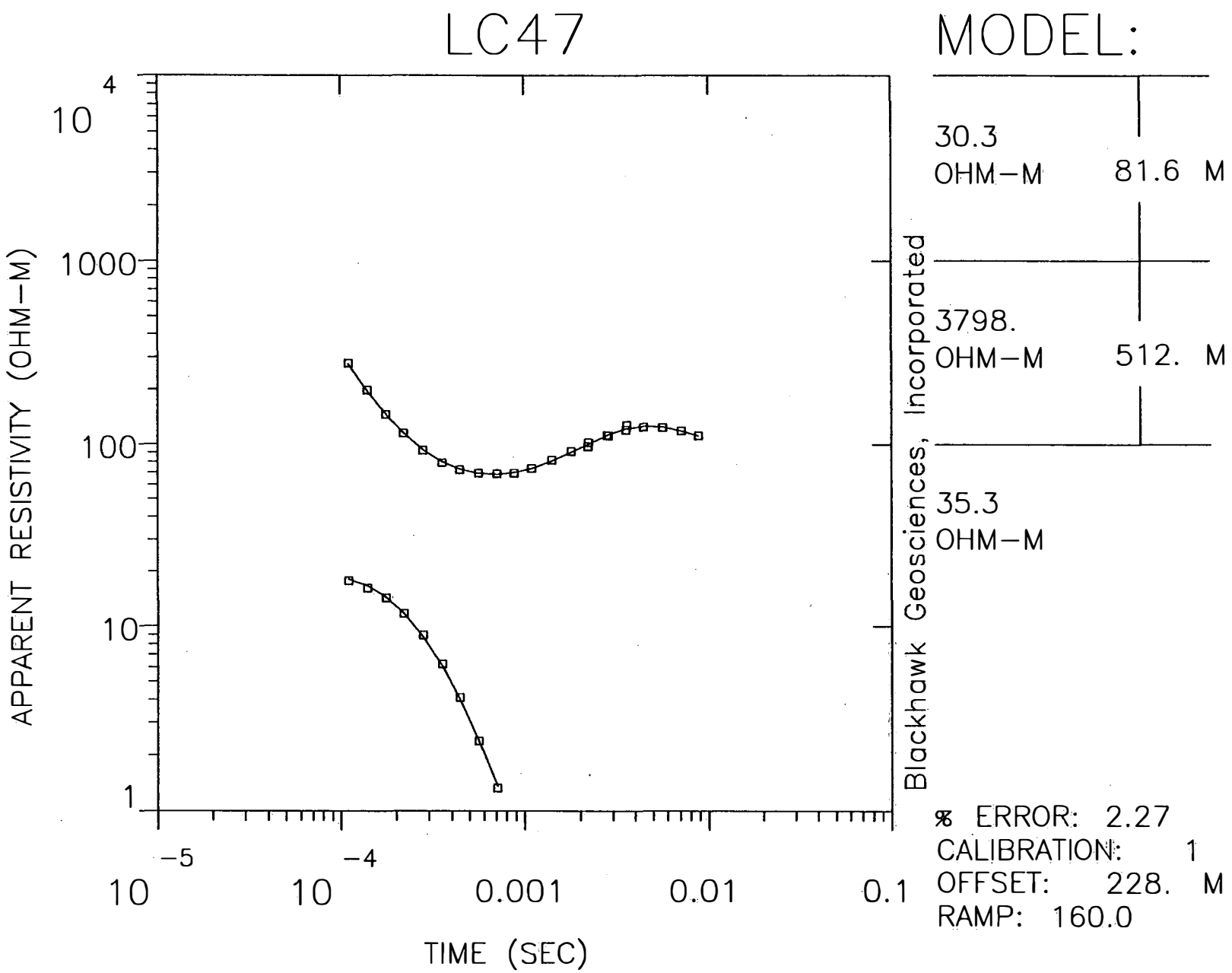
* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.81				
P 2	0.06	0.17			
P 3	0.01	-0.06	0.09		
T 1	-0.27	-0.20	0.07	0.41	
T 2	0.05	0.13	0.07	0.12	0.87
	P 1	P 2	P 3	T 1	T 2

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	32.668	56.063	60.871
	2	140.285	211.211	284.538
	3	10.815	13.897	22.056
THICK	1	24.503	79.846	95.592
	2	278.247	295.251	373.071
DEPTH	1	24.503	79.846	95.592
	2	362.341	375.097	397.574


LC47
MODEL:
APPARENT RESISTIVITY (OHM-M)
10 4
1000
100
10
1
10 -5
10 -4
0.001
0.01
0.1
TIME (SEC)
30.3
OHM-M
81.6 M
3798.
OHM-M
512. M
35.3
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 2.27
CALIBRATION: 1
OFFSET: 228. M
RAMP: 160.0

LC47

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		399.0	1309.0		
30.33	81.6	317.4	1041.2	2.7	2.7
3798.26	511.7	-194.3	-637.6	0.1	2.8
35.27					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	1.10E-04	2.78E+02	2.74E+02	1.351	
2	1.40E-04	1.98E+02	1.95E+02	1.752	
3	1.77E-04	1.46E+02	1.45E+02	0.500	
4	2.20E-04	1.15E+02	1.15E+02	-0.128	
5	2.80E-04	9.22E+01	9.33E+01	-1.122	
6	3.55E-04	7.90E+01	8.01E+01	-1.457	
7	4.43E-04	7.21E+01	7.28E+01	-0.993	
8	5.64E-04	6.90E+01	6.88E+01	0.334	
9	7.13E-04	6.90E+01	6.80E+01	1.370	
10	8.81E-04	6.93E+01	6.97E+01	-0.485	
11	1.10E-03	7.38E+01	7.35E+01	0.349	
12	1.41E-03	8.17E+01	8.08E+01	1.168	
13	1.80E-03	9.12E+01	9.03E+01	1.073	
14	2.20E-03	9.67E+01	9.98E+01	-3.121	
15	2.22E-03	1.02E+02	1.00E+02	1.294	
16	2.80E-03	1.12E+02	1.12E+02	0.074	
17	2.85E-03	1.11E+02	1.12E+02	-1.396	
18	3.55E-03	1.19E+02	1.21E+02	-1.470	
19	3.60E-03	1.27E+02	1.21E+02	4.581	
20	4.43E-03	1.24E+02	1.25E+02	-0.865	
21	5.64E-03	1.23E+02	1.24E+02	-0.668	
22	7.13E-03	1.18E+02	1.18E+02	0.108	
23	8.81E-03	1.11E+02	1.11E+02	0.249	

R: 228. X: 0. Y: 229. DL: 457. REQ: 254. CF: 1.0000
CLHZ ARRAY, 23 DATA POINTS, RAMP: 160.0 MICROSEC, DATA: LC47
1411 LC 4700NZ OPR XTL L 6 12+1000
Ch.21 = 0.16 Ch.22 = 0.89 Ch.23 = 11 Ch.24 = 20
RMS LOG ERROR: 9.75E-03, ANTILOG YIELDS 2.2708 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

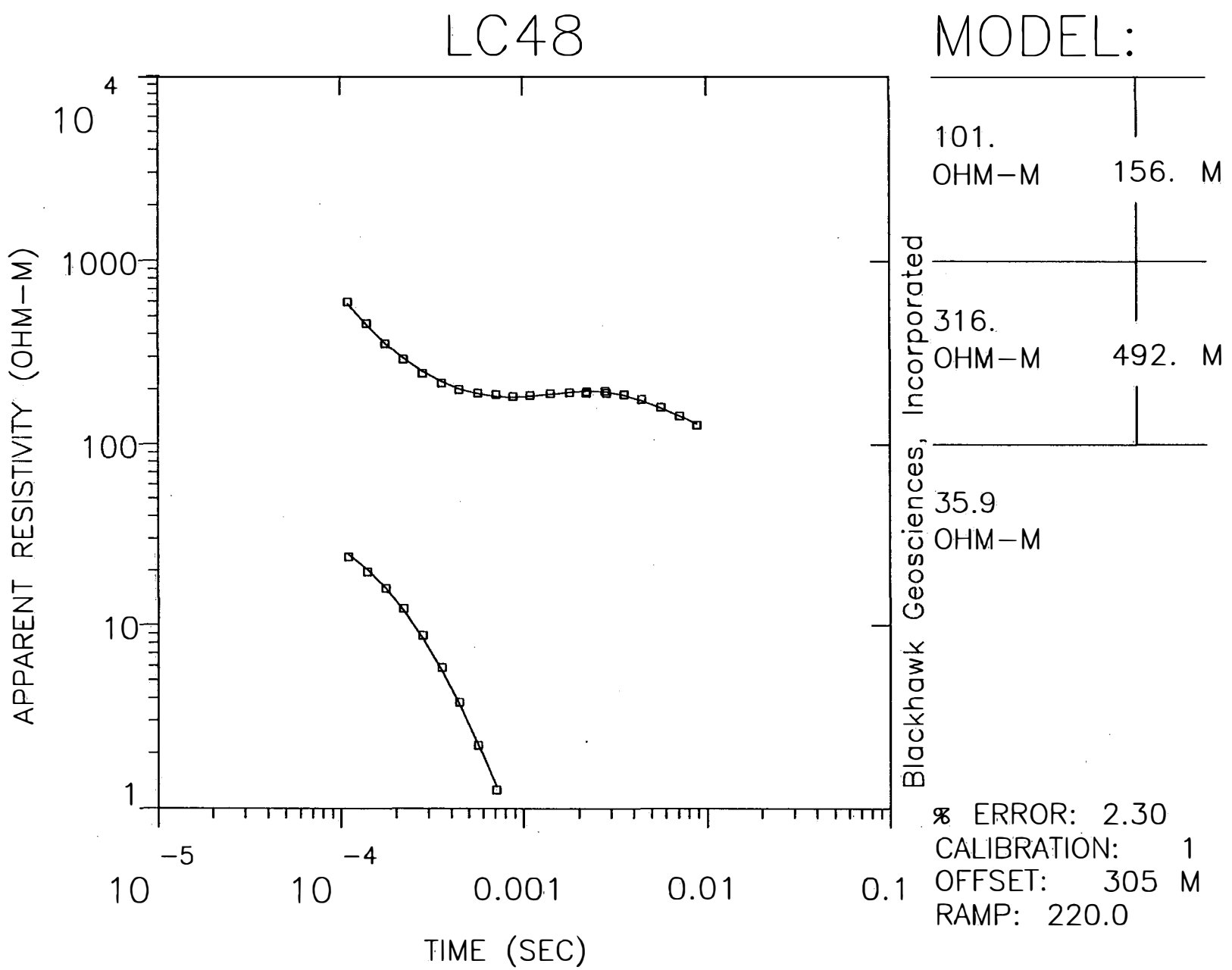
PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	1.00				
P 2	0.00	0.07			
P 3	0.00	-0.05	0.96		
T 1	0.00	-0.01	0.00	1.00	
T 2	0.00	0.02	0.01	0.00	1.00

P 1 P 2 P 3 T 1 T 2

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	28.228	30.327	32.100
	2	1395.703	3798.257	12011.141
	3	25.619	35.269	49.717
THICK	1	73.697	81.625	88.617
	2	467.118	511.703	556.419
DEPTH	1	73.697	81.625	88.617
	2	547.384	593.328	639.314


LC48
MODEL:
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
101.
OHM-M
156. M
316.
OHM-M
492. M
35.9
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 2.30
CALIBRATION: 1
OFFSET: 305 M
RAMP: 220.0

LC48

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		587.0	1926.0		
100.69	155.6	431.5	1415.5	1.5	1.5
315.51	491.5	-60.1	-197.1	1.6	3.1
35.88					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	1.10E-04	5.99E+02	5.85E+02	2.397	
2	1.40E-04	4.55E+02	4.46E+02	1.871	
3	1.77E-04	3.54E+02	3.55E+02	-0.154	
4	2.20E-04	2.92E+02	2.95E+02	-1.212	
5	2.80E-04	2.44E+02	2.50E+02	-2.362	
6	3.55E-04	2.15E+02	2.20E+02	-2.147	
7	4.43E-04	1.99E+02	2.01E+02	-1.106	
8	5.64E-04	1.91E+02	1.89E+02	1.026	
9	7.13E-04	1.88E+02	1.83E+02	2.744	
10	8.81E-04	1.83E+02	1.81E+02	0.901	
11	1.10E-03	1.85E+02	1.83E+02	1.115	
12	1.41E-03	1.90E+02	1.88E+02	0.992	
13	1.80E-03	1.92E+02	1.93E+02	-0.513	
14	2.20E-03	1.90E+02	1.96E+02	-2.600	
15	2.22E-03	1.95E+02	1.96E+02	-0.489	
16	2.80E-03	1.96E+02	1.94E+02	0.998	
17	2.85E-03	1.90E+02	1.93E+02	-1.519	
18	3.55E-03	1.87E+02	1.86E+02	0.468	
19	4.43E-03	1.76E+02	1.74E+02	1.429	
20	5.64E-03	1.60E+02	1.58E+02	1.210	
21	7.13E-03	1.43E+02	1.42E+02	0.228	
22	8.81E-03	1.27E+02	1.29E+02	-1.544	

R: 305. X: 0. Y: 305. DL: 610. REQ: 339. CF: 1.0000
CLHZ ARRAY, 22 DATA POINTS, RAMP: 220.0 MICROSEC, DATA: LC48
1511 LC 4800NZ OPR XTL L 5 12+1000
Ch.21 = 0.22 Ch.22 = 0.89 Ch.23 = 10.5 Ch.24 =
RMS LOG ERROR: 9.87E-03, ANTILOG YIELDS 2.2988 %
LATE TIME PARAMETERS

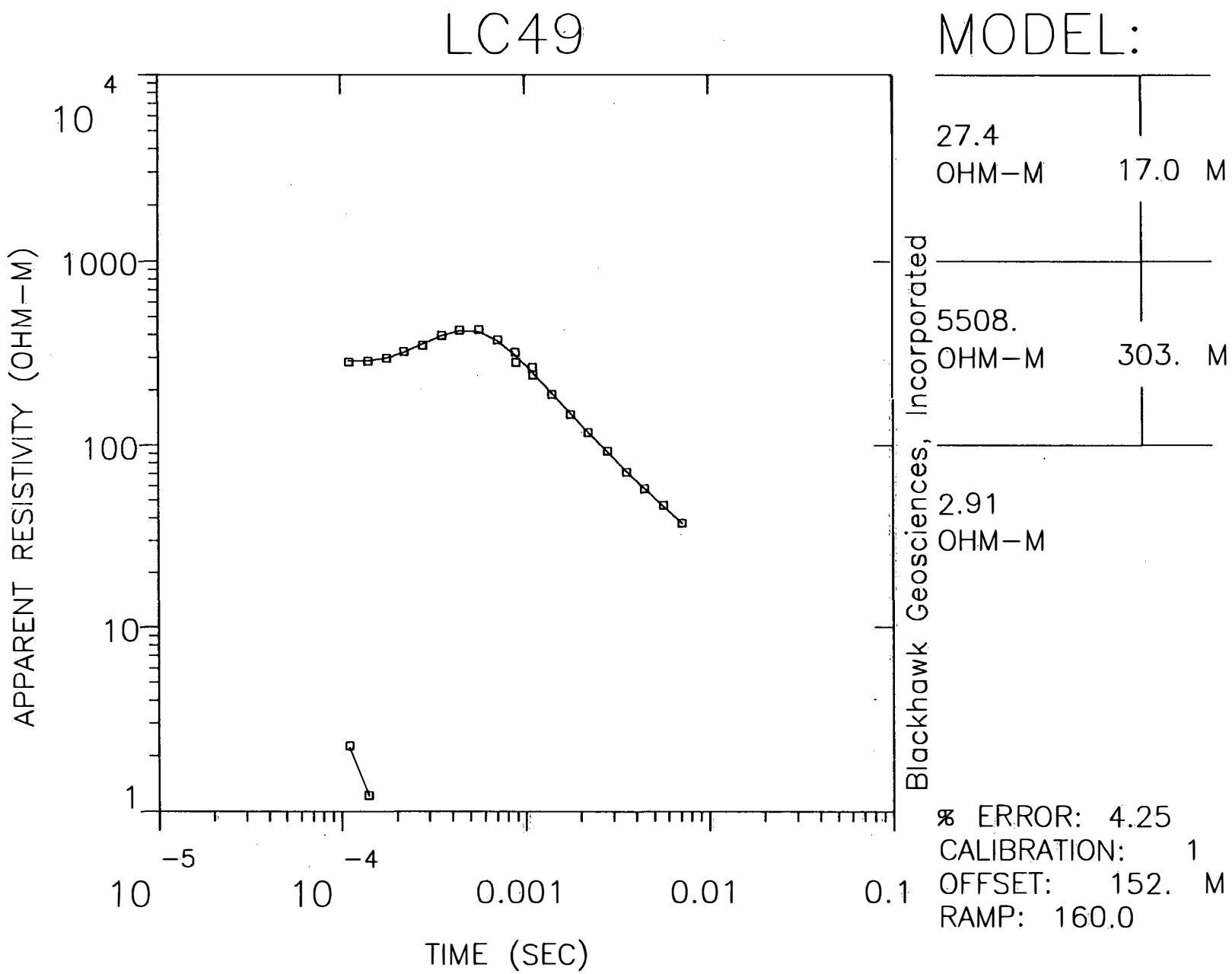
* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	1.00				
P 2	0.00	0.98			
P 3	0.00	-0.01	0.99		
T 1	0.00	-0.01	0.00	1.00	
T 2	0.00	0.01	0.00	0.00	1.00
	P 1	P 2	P 3	T 1	T 2

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	97.700	100.688	104.242
	2	259.913	315.512	401.409
	3	28.263	35.876	45.541
THICK	1	136.121	155.592	181.482
	2	444.723	491.522	537.468
DEPTH	1	136.121	155.592	181.482
	2	618.220	647.114	680.951


LC49
MODEL:
27.4
OHM-M
17.0 M
5508.
OHM-M
303. M
2.91
OHM-M
APPARENT RESISTIVITY (OHM-M)
10^4
1000
100
10
1
10^-5
10^-4
0.001
0.01
0.1
TIME (SEC)
Blackhawk Geosciences, Incorporated
% ERROR: 4.25
CALIBRATION: 1
OFFSET: 152. M
RAMP: 160.0

LC49

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		310.9	1020.0		
27.40	17.0	293.9	964.2	0.6	0.6
5507.60	303.3	-9.4	-31.0	0.1	0.7
2.91					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	1.10E-04	2.85E+02	2.88E+02	-1.219	
2	1.40E-04	2.87E+02	2.88E+02	-0.328	
3	1.77E-04	2.99E+02	3.00E+02	-0.403	
4	2.20E-04	3.23E+02	3.21E+02	0.595	
5	2.80E-04	3.51E+02	3.55E+02	-1.320	
6	3.55E-04	3.96E+02	3.94E+02	0.587	
7	4.43E-04	4.23E+02	4.20E+02	0.672	
8	5.64E-04	4.27E+02	4.14E+02	2.970	
9	7.13E-04	3.76E+02	3.68E+02	2.057	
10	8.81E-04	3.22E+02	3.09E+02	4.313	
11	8.90E-04	2.82E+02	3.06E+02	-7.811	
12	1.10E-03	2.66E+02	2.48E+02	6.948	
13	1.10E-03	2.41E+02	2.47E+02	-2.621	
14	1.40E-03	1.89E+02	1.91E+02	-0.988	
15	1.77E-03	1.48E+02	1.49E+02	-0.707	
16	2.20E-03	1.17E+02	1.18E+02	-0.581	
17	2.80E-03	9.28E+01	9.18E+01	1.079	
18	3.55E-03	7.12E+01	7.22E+01	-1.371	
19	4.43E-03	5.81E+01	5.81E+01	-0.026	
20	5.64E-03	4.70E+01	4.62E+01	1.786	
21	7.13E-03	3.73E+01	3.74E+01	-0.042	

R: 152. X: 0. Y: 153. DL: 305. REQ: 170. CF: 1.0000
CLHZ ARRAY, 21 DATA POINTS, RAMP: 160.0 MICROSEC, DATA: LC49
1511 LC 4900NZ OPR XTL L 5 12+100
Ch.21 = 0.16 Ch.22 = 0.89 Ch.23 = 15 Ch.24 = 93
RMS LOG ERROR: 1.81E-02, ANTILOG YIELDS 4.2482 %
LATE TIME PARAMETERS

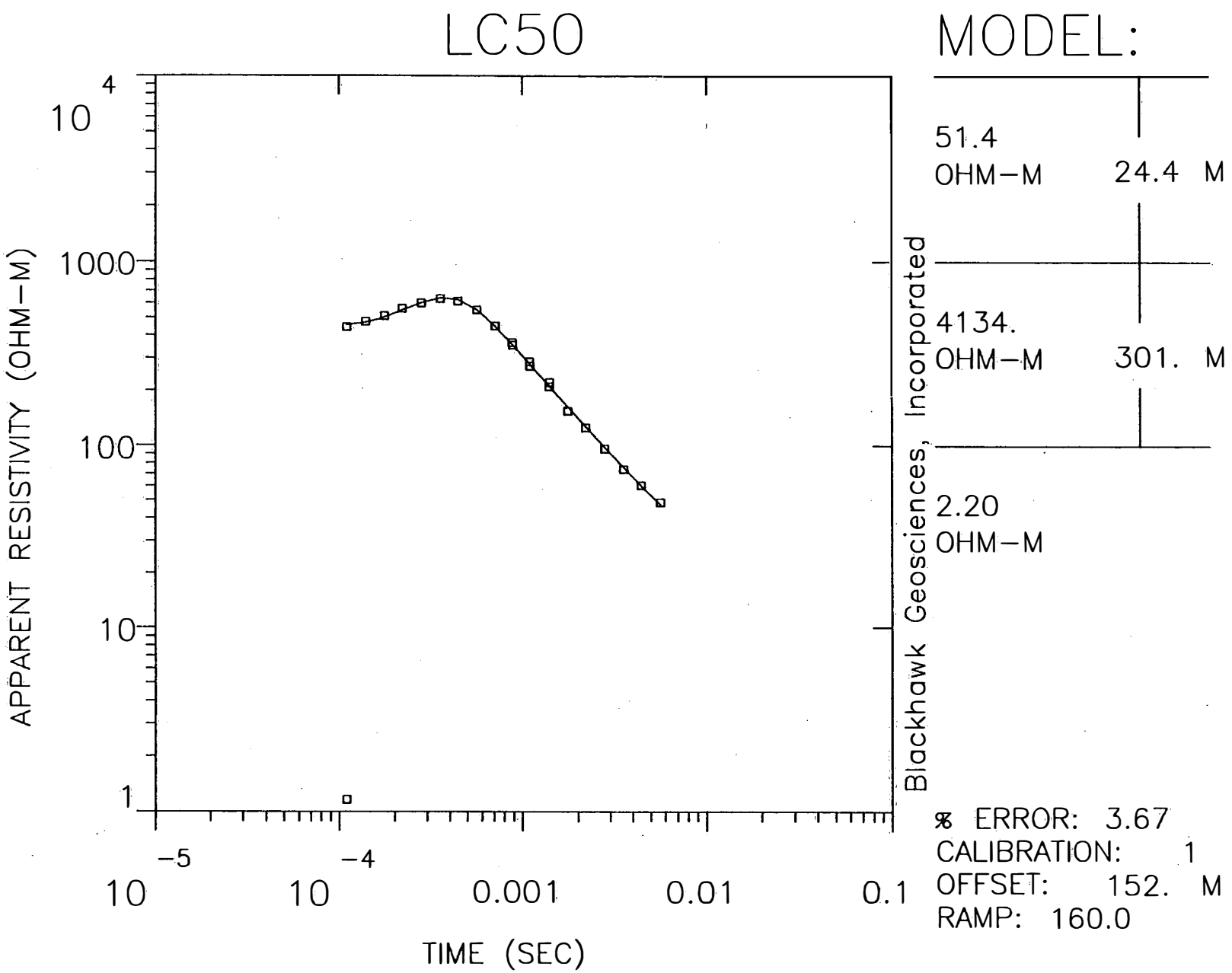
* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2
P 1	0.81				
P 2	-0.01	0.00			
P 3	0.10	-0.01	0.70		
T 1	-0.21	-0.04	0.11	0.77	
T 2	0.01	0.00	-0.02	0.01	1.00

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	16.842	27.404	37.008
	2	3097.152	5507.601	17416.564
	3	2.226	2.911	3.727
THICK	1	10.057	17.000	23.604
	2	294.452	303.341	312.536
DEPTH	1	10.057	17.000	23.604
	2	314.763	320.341	325.301


LC50
APPARENT RESISTIVITY (OHM-M)
10 4
1000
100
10
1
10 -5
10 -4
0.001
0.01
0.1
TIME (SEC)
MODEL:
51.4
OHM-M
24.4 M
4134.
OHM-M
301. M
2.20
OHM-M
Blackhawk Geosciences, Incorporated
% ERROR: 3.67
CALIBRATION: 1
OFFSET: 152. M
RAMP: 160.0

LC50

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		291.1	955.0		
51.42	24.4	266.7	874.9	0.5	0.5
4134.16	301.5	-34.8	-114.1	0.1	0.5
2.20					

	TIMES	DATA	CALC	% ERROR	STD ERR
1	1.10E-04	4.42E+02	4.54E+02	-2.687	
2	1.40E-04	4.72E+02	4.70E+02	0.613	
3	1.77E-04	5.10E+02	5.02E+02	1.645	
4	2.20E-04	5.59E+02	5.46E+02	2.513	
5	2.80E-04	5.97E+02	6.01E+02	-0.722	
6	3.55E-04	6.30E+02	6.38E+02	-1.257	
7	4.43E-04	6.12E+02	6.25E+02	-2.186	
8	5.64E-04	5.47E+02	5.49E+02	-0.279	
9	7.13E-04	4.47E+02	4.45E+02	0.404	
10	8.81E-04	3.64E+02	3.55E+02	2.454	
11	8.90E-04	3.53E+02	3.51E+02	0.614	
12	1.10E-03	2.85E+02	2.78E+02	2.623	
13	1.10E-03	2.70E+02	2.77E+02	-2.406	
14	1.40E-03	2.08E+02	2.11E+02	-0.987	
15	1.41E-03	2.21E+02	2.09E+02	6.058	
16	1.77E-03	1.54E+02	1.62E+02	-4.616	
17	2.20E-03	1.25E+02	1.27E+02	-1.552	
18	2.80E-03	9.58E+01	9.77E+01	-1.902	
19	3.55E-03	7.39E+01	7.59E+01	-2.680	
20	4.43E-03	6.06E+01	6.04E+01	0.305	
21	5.64E-03	4.87E+01	4.75E+01	2.658	

R: 152. X: 0. Y: 153. DL: 305. REQ: 170. CF: 1.0000
CLHZ ARRAY, 21 DATA POINTS, RAMP: 160.0 MICROSEC, DATA: LC50
1511 LC 5000NZ OPR XTL L 6 12+100
Ch.21 = 0.16 Ch.22 = 0.89 Ch.23 = 15 Ch.24 = 93
RMS LOG ERROR: 1.56E-02, ANTILOG YIELDS 3.6686 %
LATE TIME PARAMETERS

* Blackhawk Geosciences, Incorporated *

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	0.80				
P 2	-0.02	0.01			
P 3	0.10	-0.02	0.60		
T 1	-0.22	-0.05	0.13	0.76	
T 2	0.02	0.00	-0.04	0.02	1.00
	P 1	P 2	P 3	T 1	T 2

PARAMETER BOUNDS FROM EQUIVALENCE ANALYSIS

	LAYER	MINIMUM	BEST	MAXIMUM
RHO	1	29.862	51.423	64.225
	2	1974.344	4134.162	13073.368
	3	1.641	2.200	2.900
THICK	1	13.489	24.402	31.122
	2	289.799	301.467	319.072
DEPTH	1	13.489	24.402	31.122
	2	319.502	325.869	332.560